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60 YEARS ON: THE 1957 DEFENCE WHITE PAPER

ISSUE 20

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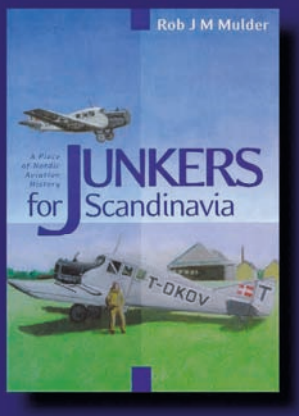

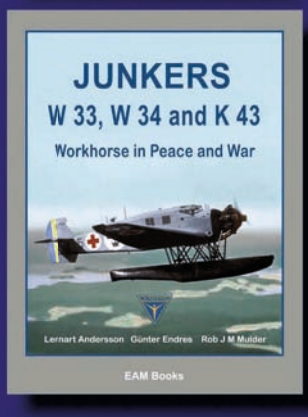

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Editor's Letter

A SEASONALLY WARM welcome to our 20th issue, another milestone for us and — we hope — another edition packed to the hangar roof with new and fascinating material for you. Our plan has always been to bring fresh perspectives to light, and Matt Bearman's compelling investigation into the *real* reason why the Westland Whirlwind never lived up to its operational expectations emphasises how often "conventional wisdom", particularly about this aircraft, is revealed to be little more than an aggregation of lazy clichés established as fact by endless repetition. The Whirlwind *did* have early troubles with its propulsion — but not in the way you're probably thinking.

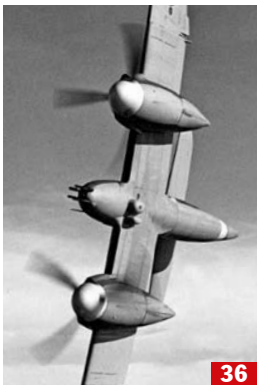
Talking of perceived wisdom, we continue our coverage of 1957's Defence White Paper with Greg Baughen's appraisal of the RAF's historical attitude to unmanned aircraft — which, contrary to popular myth, had always been one of keen interest; so was it *that* big a surprise when Duncan Sandys decreed no more manned fighters? And since distinguished airpower thinkers like Hugh Dowding had long viewed pilots as "the weak link" in air-defence systems, wouldn't it make sense to strengthen those systems with "billion-dollar brains" instead?

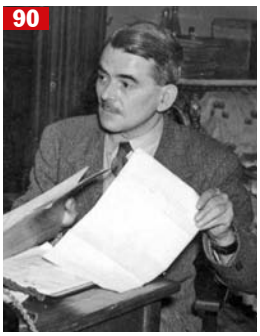
Unmanned air defence certainly came into its own for the French when faced with Libya's Tupolev Tu-22 *Blinder* bombers in neighbouring Chad in the 1980s, as detailed in our dramatic account of the often-suicidal missions undertaken by the Soviet-built bombers' Libyan Arab Air Force crews.

Finally, thanks to *TAH* reader Mick Jeffries, who asked us to take an in-depth look at a 1939 plan to fit an early Whittle jet engine into an Avro Anson. Yes, an Anson. We love it when readers let us know what they want to see — so if you have a subject you think we should turn our spotlight on, tell us!

FRONT COVER ***The first line of defence on the Cold War frontier — an RAF pilot climbs aboard an English Electric Lightning F.3 at Wattisham in 1965.*** CROWN COPYRIGHT/MOD VIA RAF AIR HISTORICAL BRANCH

BACK COVER ***Avro Yorks framed by the fin of a Trans-Canada Air Lines North Star at Heathrow in 1948.*** JOHN STROUD © A FLYING HISTORY LTD





CONTENTS Issue No 20

AIR CORRESPONDENCE

Letters to the Editor

Exploring those excrescences . . .

SIR — The picture of the row of Pembrokes at Weybridge [page 8 of *TAH19* — detail reproduced below] brought back memories, as I was in my first year as an undergraduate apprentice at the time. My recollection is that all refurbished airframes were fitted with the bulge above the cockpit [see XF799, third from camera], which involved cutting through the structure and fitting a new dished panel. I have checked my notes but nothing of any value! I am fairly sure that the main reason for the bulge was the fitting of a later version of Decca Navigator unit which was deeper than the earlier version. This seems at variance with your caption, and fitting the controls mentioned would probably not require this quite complex modification.

Refurbishment work was quite common at Weybridge, with cowlings for Vickers Varsity trainers in the shops at the same time, along with re-sparring of Viscounts following the crash of an example in Australia. For those of us used to watching new aeroplanes come together, it was fascinating to see older ones being stripped back and rebuilt for extended service.

Vaughan Pomeroy *South Croydon, Surrey*

BROOKLANDS MUSEUM

Note the cockpit-roof bulge on Pembroke XF799, third from camera.

. . . and probing those probes

SIR — I was intrigued by the wingtip probes on Boeing KC-135 serial 55-3126 *(The Speckled Trout from Moses Lake, TAH18).* They are not there on the photographs at Renton/Moses Lake/Boeing Field, but appear in all the others except the last one at Davis-Monthan. They're fairly meaty, but what are they for? I think we need to be told — over to you! ***[See the response from the article's author, at the end of this letter — Ed.]***

They are similar to the standard fin-mounted pitot probe; companies spent lots of time trying out different positions for these and, yes, some aircraft have multiple probes because of auto-pilots and so on. They might be something to do with the 707's roll/yaw stabilisation, as the 707 family is very inclined to dutch-roll in manual. I have a photograph of presumably the next KC-135 off the line, 55-3127, but no probes and, equally, I can't find a photograph of any KC-135/VC-137 with these probes.

Graham Skillen *North Cheriton, Somerset*

Author Robert S. Hopkins III responds: "Reader Skillen has a sharp eye for detail. The wingtip probes on 55-3126 were HF radio antennae. LeMay was an ardent short-wave radio enthusiast, and transferred his hobby into an operational capability. They were essentially the same structure as the HF antenna mounted on the top of the fin, and were used on airborne command posts such as the EC-135G and EC-135C in addition to the long-wire HF antenna. Wingtip pitot tubes were used on aircraft with modified noses, such as the RC-135 (some of which also carried the extra HF antenna), and are clearly different in shape and location [see pictures opposite — Ed]."

Test-flying the HS 748

SIR — It was with great pleasure that I read Brian Turpin's article on flying the Avro/Hawker Siddeley 748 with Skyways *(Further Out on a Lympne, TAH19).* It brought back happy memories of flying the aircraft from Eric Rylands' very soggy grass airfield at Lympne. At the time I was a military test pilot flying the Vulcan at Avro's

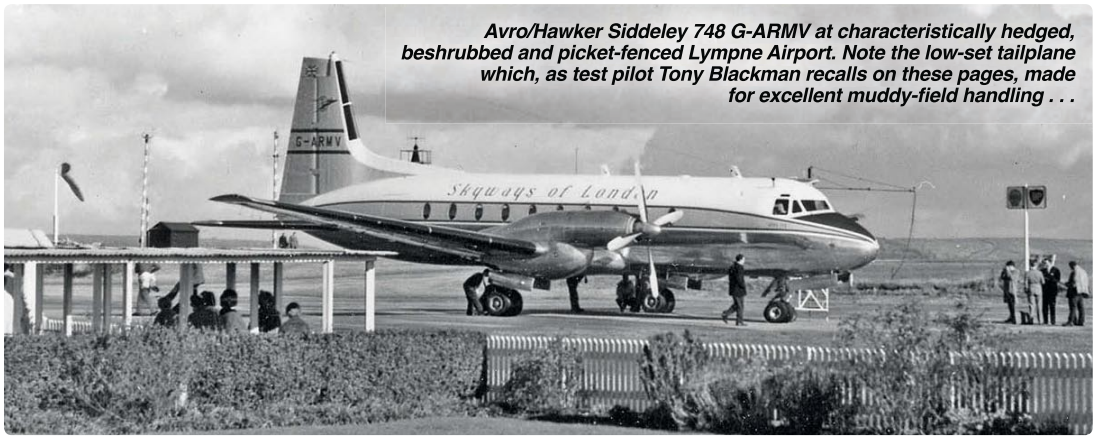
airfield at Woodford, and then to our delight and surprise Avro decided to re-enter the commercial airliner market with a DC-3 replacement, allowing us to demonstrate the 748's capability to doubting potential customers. Jimmy Harrison was Chief Test Pilot at the time and I was helping him certificate the aircraft; our first customers were Aerolineas Argentinas and Skyways.

At the time all a firm's test pilot needed to test aircraft was a private pilot's licence, but I was determined to match the licences of the pilots who were going to operate the 748 by getting an airline transport pilot's licence. This proved to be a bit of a challenge as I had to prove in my logbook that I had done sufficient navigation flying by day and by night. I managed somehow to get agreement that I could fly in an RAF squadron Avro Shackleton Mk 2 from Ballykelly to Gibraltar and back at night and then, flushed

USAF Boeing EC-135C 62-581 was equipped with the same wingtip HF radio antennae that were fitted to Gen Curtis LeMay's KC-135 55-3126, which was featured in* TAH18 *— see Graham Skillen's letter and the author's comments opposite.

USAF x 2

In contrast to the above, RAF RC-135W Airseeker ZZ664 has wingtip pitot tubes.



Avro/Hawker Siddeley 748 G-ARMV at characteristically hedged, beshrubbed and picket-fenced Lympne Airport. Note the low-set tailplane which, as test pilot Tony Blackman recalls on these pages, made for excellent muddy-field handling . . .

. . . while, by comparison, the 748's military transport version, the Andover, lost that advantage owing to its tailplane being set higher because of the rear loading ramp.

TAH ARCHIVE x 2

with success, I sent my logbooks to the CAA with the navigation flights marked in pencil — and I see that the marks are still there to this day.

My next challenge was actually to *use* my gleaming new ALTP licence, and the only way I could do this was to fly with Skyways, which had just taken delivery of its new aircraft. The airline agreed that I could fly over Easter 1964, which actually helped them as they were flying extra flights over the holiday. I can't remember my check flights, though they were in the ill-fated 'MV, or even my first flight as captain, but I do remember the airfield. As Brian mentioned, it could get very soft, but the great thing about the 748 was that the slipstream from the engines went over the tailplane and elevators. Consequently, as the aircraft grudgingly accelerated over the clinging muddy surface, the stick would be pulled hard back which not only lifted the nosewheels off the ground but also reduced the mainwheels sinking into the grass. This had the effect of getting the aircraft to start accelerating, which was a great relief to all concerned. Interestingly, on the military version of the 748, the Andover Mk 1, the tailplane was set higher and out of the slipstream so that in some ways the 748 was better taking off from a muddy airfield. In the end I flew with Skyways for three Easters, finishing in 1966.

There were two features of the 748 I remember well. The first was the built-in control locks lever so that it was impossible to open the throttles to full power without taking the control locks out. I read quite recently of a very modern well-known jet business aircraft which has a control lock lever which apparently does not prevent the throttles going to full power; this resulted in a very nasty take-off accident because the controls were still locked as the pilots selected take-off power. The other feature I remember was the control forces required during take-off in the event of an engine failure; the certification requirements at the time allowed a rudder force of 180lb to be used to determine the minimum

control speed in the air — unbelievable in the present day with lady pilots. Furthermore, to demonstrate the minimum control speed on the ground during take-off it was necessary to apply full forward stick, full left aileron and full left rudder immediately to keep straight as the aircraft slowly accelerated along the runway following the engine failure. I remember one of the certification pilots saying at the time, "The 748 is really like two aircraft, one with both engines going and one with an engine failed". There is no doubt that the 748 was a very demanding aircraft if an engine failed during take-off.

The 748 was quite a successful aircraft, with some 293 built, and another 65-odd ATPs, a descendant of the 748, added to that; more than the BAC One-Eleven (236) and the Handley Page Herald (50) put together — not bad going. I'm not sure how much money Avro made from building the aircraft, but we test pilots had the good fortune of broadening our flying experiences by flying the aircraft all over the world into some very demanding, not to mention beautiful, airfields. For me, I will always remember flying over Lake Titicaca in Bolivia at 13,500ft on one engine, measuring performance, wondering what I had done to be so lucky.

Tony Blackman *via e-mail*

Fellow test pilot Sir Charles Masefield adds a comment: "Tony, I loved your letter on the 748. You have certainly picked the best and worst feature of the aircraft.

"As you say, the feature that enabled the aircraft to take off from extraordinarily soft runways, including very soft sand, was the amazing elevator effectiveness within full-power slipstream. Again as you say, demonstrating V_{mcg} [minimum control speed on the ground] was most counter-intuitive. When Nick Warner came to Woodford to certificate the more powerful 748 2B, although I had briefed him on the technique, his first attempt speared us straight off the runway on to the grass! I blame Jimmy and you for coming up with this clever trick — but the resulting certified field length certainly sold us a lot of aircraft. 180lb foot force at the V_{mca} [minimum control speed in the air] of 86kt is also unimaginable today."

BEA helicopter history

SIR — further to your article *The South Bank Show* in *TAH13*, about BEA helicopter operations in London during 1955–56, the accompanying document (**BELOW**) is a typewritten summary of services based on the "archived" timetables in the office where I was working in 1977. I left "Timetables" in September 1982 when I departed from BritAir; some time later, the office was "outsourced", to OAG I think. I have no idea what happened to the Timetables "archive", which was BEA-only anyway.

All sources of information are indicated — but the usual caveat applies: what was on paper may not have reflected what actually happened.

Joel Kosminsky *via e-mail*

Wish they'd thought of that

SIR — Just a thought about the article *Swing-wing London?* in *TAH17*: given that General Dynamics was the successor company to Consolidated, and the F-111 was to be used as a bomber/reconnaissance aircraft, why didn't the RAF and RAAF consider the name Liberator 2?

Brian Cope *Finham, Coventry, West Midlands*

BEA Helicopter Services London(South Bank) - London(Heathrow Airport)

This was one of a series of experimental helicopter services in the 1950s, being immediately preceded by a service from South Bank to Southampton (via Gatwick).

The service was first published in the 12JUN55 timetable, although Supplement no 1 to this edition says that the service was postponed.

The service operated on "Weekdays", which is presumed to mean Mondays-Fridays, with a Summer frequency of 8 round-trips per day.

Fares published were 30/- (£1.50) One Way, 60/- (£3.00) Return. There was no indicated validity of the Return fare, so presumably it was valid for one year, which is the current practice on both International and Domestic fare structures. Also part of the Tariff structure was an Excess Baggage rate of 6d (2½p) per kilogram, although the free baggage allowance was not specified in the page containing the timetable for the service.

The aircraft used for the service were two types of helicopter, although both were listed under the title of "King Arthur"; they were either Bristol 171 Mk III (seating 4 passengers) or Westland-Sikorski W.S.55 (6-passenger) helicopters.

The next published change appeared in Amendment no 1 to the timetable for the period 01AUG55-01OCT55, which stated both that the service was now fully operational and that the fares had increased to 35/- (£1.75) and 70/- (£3.50).

The next edition, 02OCT55, had no further changes except that the Winter 55/56 frequency was reduced to 4 round-trips, still on weekdays only, still with King Arthur helicopters.

The last timetable to show the service was the 02MAR56 edition, with ~~caused~~ an additional note that the service would cease on 31MAR56.

The South Bank to Heathrow service does not appear in the 01JUN56 edition, but a new helicopter operation from Nottingham via Leicester to Birmingham is shown, to commence from 03JUL56, again using the King Arthur aircraft.

Joel Kosminsky, Timetables Unit, Room 637, WLT.
15DEC77.

60 YEARS ON Duncan Sandys & the 1957 Defence White Paper

A Brief History of the Future

Continuing our re-examination of the 1957 Defence White Paper 60 years on, **GREG BAUGHEN** reveals how, despite the furious "Sandystorm" that followed the publication of the paper, the concept of pilotless aircraft in the RAF was nothing new. The potential of unmanned aircraft had been explored as far back as the 1920s — indeed, Britain had long been a leading light in "cruise missile" technology

TAH ARCHIVE

FAST COLLECTION RAE 8988

DUNCAN SANDYS needs no introduction. He was the missile-obsessed fool who came up with the bright idea of abolishing manned fighter aircraft. His future RAF would need only guided missiles to defend UK airspace. For decades public speakers have used his name as a sure way of getting the audience onside. A mere mention of the name is usually enough to have the audience rolling in the aisles. And why not? He was after all entirely responsible for one of the most appalling policy decisions in the RAF's history. Or was he? Let's go back a few years.

Early pilotless aircraft

By 1957, when Sandys, as Minister of Defence, published his infamous Defence White Paper, the possibility of unmanned combat aircraft had long fascinated the RAF. In the 1920s Britain had led the way in cruise-missile technology. The RAF's founding father, Hugh "Boom" Trenchard, was especially excited by the potential of the pilotless Larynx developed by the Royal Aircraft Establishment (RAE) at Farnborough. It was the ideal weapon for the "terror bombing" he believed would decide future wars. The very randomness of the weapon could only intensify the horror of aerial bombardment. With manned bombers, civilians could at least take a small degree of comfort from the fact that the pilot was probably trying to hit a military target.

In the 1930s criticism of Trenchard's indiscriminate bombing policies forced the Air Staff to adopt a more refined precision-bombing strategy. There was no place for weapons like the Larynx, and development stopped. When the Aeronautical Research Committee, led by Sir Henry Tizard, decided that other countries might not be so particular about the bombing tactics they used, and that Britain ought to be at least ready to retaliate in the face of a pilotless bomber offensive, the Air Staff was reluctant to become involved. If such indiscriminate action was required, the War Office should be responsible, the Air Staff suggested, employing the missiles that its rocket specialist, Alwyn Crow, was conjuring up.[1] These included futuristic multi-stage rockets that would rise 300 miles (480km) into space before descending on targets 500 miles (800km) away, as well as air-breathing missiles and winged rockets that would fly within the atmosphere. None of these were any more than vague "back-of-the-envelope" ideas. All were far too indiscriminate to be of any interest to the Air Staff, which would soon be regretting its disdain.

When it came to war, RAF Bomber Command found that precision-bombing by day was impossible, and was forced to adopt "area bombing" by night. It was a policy that did not require the accuracy that manned bombers could

OPPOSITE PAGE ***The Bloodhound Mk I surface-to-air missile entered RAF service in 1958, having been developed from Bristol's*** **Red Duster** ***project.*** **ABOVE** ***At least 12 examples of the pilotless RAE Larynx (a rather tortuous acronym derived from "Long-range Gun with Armstrong Siddeley Lynx") were built and tested during 1927–29.***



ABOVE LEFT ***Rocket projectile pioneer Sir Alwyn Crow, Director of Ballistics at the Royal Arsenal, Woolwich, during 1919–39.*** **ABOVE CENTRE** ***Marshal of the Royal Air Force Hugh Trenchard, a staunch advocate of the early development of flying-bombs.*** **ABOVE RIGHT** ***Air Chief Marshal Hugh Dowding, who saw pilots as a "weak link".***

provide, and, in the summer and autumn of 1941, a switch to indiscriminate pilotless weapons was seriously considered. By this time Britain was heavily committed to the manned approach and it was felt that it was too late to switch horses midstream.[2] Germany's *Vergeltungswaffen* (V1 and V2) offensives later in the war, however, brought home to the Air Staff the advantages of unmanned weapons — if indiscriminate destruction was all that was required. Bomber Command's AOC-in-C, Sir Arthur Harris, saw Germany's cruise and ballistic missiles, despite their payload of conventional explosives, as a devastating "weapon of the next war".[3]

The arrival of the atomic bomb provided the ideal means of making these weapons even more frightening. After witnessing the dropping of the atomic bomb on Hiroshima, Gp Capt Leonard Cheshire expressed his belief that a "space projectile", which would rise 500 miles above the Earth before descending on its target, was the best way of delivering this terrible new weapon.[4]

Cold War explorations

In September 1945 the British Air Ministry issued Operational Requirement (OR) 203 for a long-range expendable bomber capable of carrying ordnance of up to 10,000lb (4,535kg) — the weight of an atom bomb — to a target at least 1,500 miles (2,400km) away at supersonic speed and at an altitude of 40,000ft (12,200m).[5] In 1946 the RAE calculated that a 35-ton pilotless aircraft would be capable of delivering a 7,000lb (3,175kg) payload over a range of 2,000 miles (3,200km).[6]

The Air Ministry now regretted allowing the War Office sole responsibility for long-range ballistic weapons, and managed to make Crow's rocket programme a joint effort. Some of his ideas were now taking more concrete form. Early ballistic-missile proposals included huge 938-ton monsters that could deliver a 9,000lb (4,080kg) payload over 2,000 miles. The RAE predicted that by 1957 a three-stage weapon might be as light as 92 tons.[7] These were still highly speculative long-term projects, however, with course guidance remaining a huge hurdle to overcome. By the time John Slessor took over as Chief of the Air Staff in 1950, he had little doubt that the unmanned expendable bomber in some form or other would be the "ultimate answer" to the long-range delivery problem.[8] In the meantime the V-bombers — Avro Vulcan, Vickers Valiant and Handley Page Victor — would provide a more immediate and conventional way of delivering nuclear armament.

Pilotless air-defence options had also been investigated. Defending Britain against weapons of mass destruction had never been high on the Air Staff's agenda. Trenchard had always insisted that attack was the best means of defence and that fighters were only needed to keep politicians and the public happy. Britain's fighters developed in the 1920s and 1930s had bomber-interception as their sole aim. It was fortunate that British designers had come up with adaptable aircraft such as the Spitfire, capable of far more than just intercepting bombers. Even in the 1920s and 1930s it was mooted that unmanned interceptors might be able to do the job better. Ways of using Larynx-type aircraft as surface-to-air missiles were explored, but the attendant guidance problems proved too challenging at the time.[9]

These technical problems did not dampen official enthusiasm, however. Air Vice-Marshal (AVM) Hugh Dowding, Fighter Command's Commanding Officer during the Battle of Britain, had always seen the pilot as the weak link in his air-defence system. Newly-developed

CHRIS GIBSON COLLECTION

ABOVE ***The Z Battery was a British Second World War short-range anti-aircraft weapon system for home defence, which launched 3in rockets fitted with a high-explosive warhead detonated by a photoelectric proximity fuze. An experimental Z Battery was tested near Cardiff in October 1940, under the command of one Major Duncan Sandys.***

centimetric radar systems seemed to offer a way of minimising the pilot's role. In October 1940, with the Battle of Britain scarcely won, Dowding was already proposing that the prospective AI.S airborne interception radar system (the future AI Mk IX) could be used to feed information on the position of an enemy aircraft into an autopilot, which would take the interceptor into a firing position and even potentially fire the guns at the optimum moment. There was not much for the pilot to do other than take off, monitor the systems and land. The scientists were taken aback by Dowding's ambition, and doubted anything so sophisticated was possible with the technology then available.[10]

The fiction of survivability

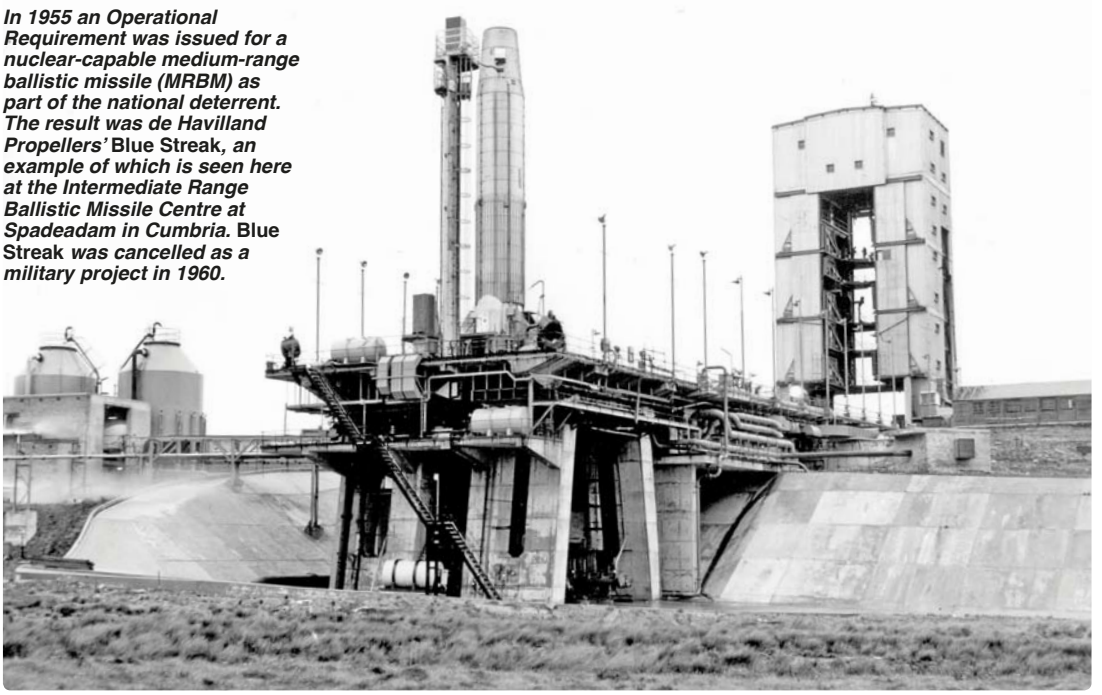
With the development of nuclear weapons apparently providing conclusive proof that conventional conflicts were a thing of the past, the post-war priority was once again shooting down the bombers that would deliver these weapons of mass destruction. A successful defence could only be defined as the loss rate inflicted on the enemy being as close to 100 per cent as possible. The pilotless surface-to-air guided weapon (SAGW) seemed to offer the only real hope of getting anywhere near this. The informal post-war arrangement left conventional (i.e. winged) pilotless aircraft in Air Ministry hands, while the War Office concentrated on "wingless" ballistic vehicles. Concurrent with the issuing of OR.203 for the long-range bomber mentioned previously, the Air Ministry also drew up OR.202 for a Mach 1·4-capable pilotless winged interceptor missile, with a range of around 30 miles (50km).[11]

By this time there was already an assumption in Air Ministry circles that the defensive and offensive weapons of the future would be unmanned. A 1945 Air Ministry report describes how pilotless aircraft will eventually replace long-range bombers, interceptors and even tactical ground-support aircraft. In the future "inhabited" aircraft, as the Air Ministry study quaintly puts it, might be restricted to those used for transport, anti-submarine and perhaps tactical reconnaissance duties.[12] Since the Air Staff believed that all future wars would be decided by strategic atomic bombing, with armies and navies playing no significant role, any possible tactical roles for aircraft did not merit much attention. For strategic defence and offence, the unmanned approach was best.

The movement of the RAF towards pilotless weapons brought about some interesting departmental conflicts. By 1948 the War Office's *Red Heathen* surface-to-air missile (SAM) programme, developed by English Electric for the Army, was becoming more ambitious and matching the 30-mile range of the Air Ministry's pilotless aircraft. This rather ruffled Air Ministry feathers, especially as *Red Heathen* had been given priority over the RAF's OR.202. In October 1948 Air Vice-Marshal John Boothman, Assistant Chief of the Air Staff (Technical Requirements), tetchily complained that it was little more than an attempt by the Army to take over Fighter Command.[13]

In 1950 the Air Staff hoped to put clear water between Army and RAF projects by reissuing OR.202, with a more ambitious aim of destroying an enemy aircraft at a range of 150 miles (240km). Given the codename *Green Water*, this was to use ramjets or other cheap expendable powerplants to fly at Mach 2.[14] Slessor enthusiastically foresaw the day when such pilotless interceptors would "almost totally" replace manned aircraft.[15]

Again it was down to the scientists to rein-in the Air Staff's enthusiasm. Sir Frederick Brundrett,



In 1955 an Operational Requirement was issued for a nuclear-capable medium-range ballistic missile (MRBM) as part of the national deterrent. The result was de Havilland Propellers'* Blue Streak, *an example of which is seen here at the Intermediate Range Ballistic Missile Centre at Spadeadam in Cumbria.* Blue Streak *was cancelled as a military project in 1960.

CHRIS GIBSON COLLECTION

the Ministry of Defence's scientific advisor and chairman of the Air Defence Committee, insisted that the claims made for surface-to-air missiles had been greatly exaggerated, and that the manned fighter would be needed "for the foreseeable future" in any air-defence system, "not to mention other uses".[16] These would be roles like tactical fighter support — but conventional war was not on the Air Staff's agenda.

Defence in stages

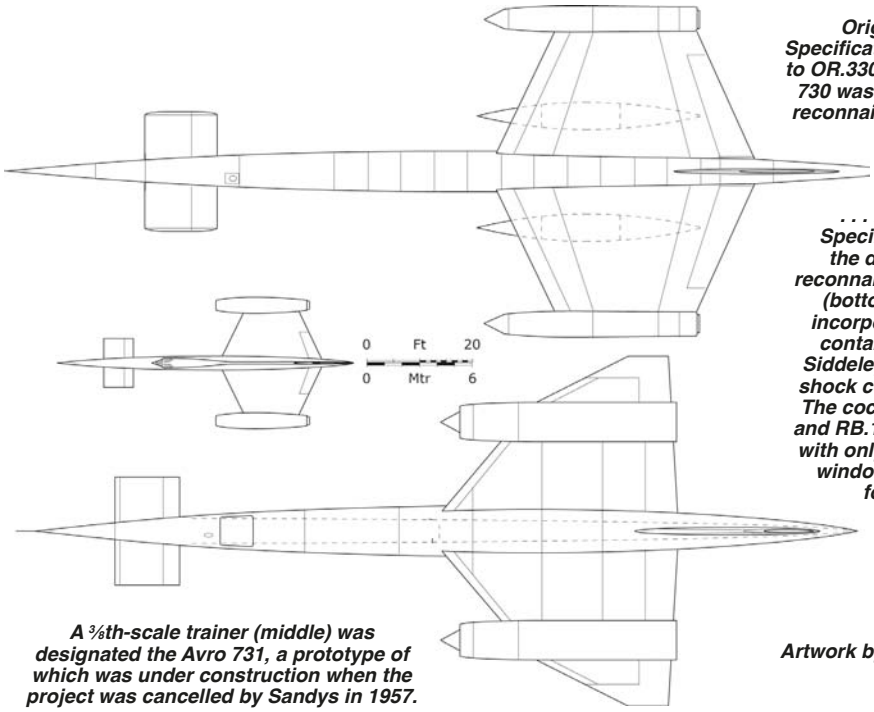
Air Ministry fears that the War Office was trying to usurp Fighter Command were removed by the decision in 1953 to transfer all surface-to-air missile development to the Air Ministry. The War Office's *Red Heathen* (by now *Red Shoes*) became an Air Ministry project. The *Green Water* pilotless aircraft could be abandoned and the Air Ministry could focus on the ballistic approach with the *Red Duster* project (developed by Bristol into the future Bloodhound) without fear that by favouring ballistic missiles it would be signing the RAF's death warrant. To consolidate the takeover it was suggested that the unpronounceable SAGW be changed to the more manageable SAPA (surface-to-air pilotless aircraft) or SAGA (surface-to-air guided aircraft).[17] The Air Ministry was evidently keen to get the word "aircraft" into the acronym, just in case anyone disputed that these were weapons for the air arm. Neither acronym caught on, but guided missiles were seen as the future "aircraft" of the RAF.

How soon they would take over from manned aircraft was a subject of much debate. *Red Shoes* and *Red Duster* were to be deployed in 1960, but neither was considered satisfactory. These "Stage 1" weapons would serve for familiarisation and training purposes; only the definitive "Stage 2" generation, due to be deployed from 1963, would be fully effective. From this point the manned interceptor would begin to fade from the scene.

Whether there would be any nuclear-armed aircraft for them to shoot down was another matter. With the Soviet Union expected to have its own effective SAMs by 1960, the Air Ministry knew its manned bomber fleet would not be effective for long. In 1953 OR.203 was reissued, with a ballistic missile approach the preferred option. English Electric optimistically proposed single- and multi-stage vehicles with clusters of up to 33 x 10,000lb-thrust rockets, in the style of the first Soviet ballistic missiles.[18] Guidance was still a problem, but the Americans solved this to some degree by developing the hydrogen bomb. So much greater was the latter's destructive power that a missile could miss a city by a wide margin and still destroy it. The long-range ballistic missile was no longer a pipedream.

In August 1954 Sandys, then Minister of Supply, signed the Wilson-Sandys Agreement with the USA, under which British and American ideas and resources would be pooled. The agreement did not extend to thermonuclear weapons — the UK would have to develop these on its own — but Britain was able to acquire the Rocketdyne S-3 liquid-propellant rocket engine, which would power de Havilland's *Blue Streak*, the UK's own medium-range ballistic missile. The RAF might have a usable long-range missile by 1965.[19]

To bridge the gap between this and the existing



Originally designed to Specification R.156, which related to OR.330, the eight-engined Avro 730 was initially just a strategic reconnaissance aircraft (top) . . .

. . . however, a revised Specification, RB.156, saw the design modified as a reconnaissance aircraft/bomber (bottom) with a delta wing incorporating nacelles, each containing four Armstrong Siddeley P.176 turbojets and a shock cone at the forward end. The cockpits of both the R.156 and RB.156 were fully enclosed, with only one small side-facing window on each side of the forward fuselage.

A ⅜th-scale trainer (middle) was designated the Avro 731, a prototype of which was under construction when the project was cancelled by Sandys in 1957.

Artwork by CHRIS GIBSON © 2017

V-bombers, OR.330 specified the requirements for a supersonic long-range strategic reconnaissance aircraft/bomber. If proceeded with, it would be a very expensive way of filling a relatively small gap in Britain's ability to deliver nuclear weapons.

The Soviet Union was expected to develop its own ballistic missiles at least as quickly. It seemed that by 1967 Britain would have no manned threat to deal with.[20] Against ballistic missile attacks any defence seemed impossible. The era of the surface-to-air missile as a defence against an air-delivered nuclear attack might be very brief. The Air Ministry, however, pushed on with its development.

The definitive Stage 2 missile was somewhat ambitious, so English Electric was tasked with developing its rocket-powered *Red Shoes* into what was initially known as *Green Flax*, but which hurriedly became *Yellow Temple* when a *Green Flax* file went missing. This would have improved radar and was supposed to become available around 1960 as a "Stage 1½" weapon. This would be followed by another interim "Stage 1¾" weapon, which would extend the impact range to 80 miles (130km).[21]

The ramjet-powered *Red Duster* offered the potential of greater range and Bristol was to develop this into *Blue Envoy*, expected to become available by 1962–63.[22] Even *Yellow Temple* would be little more than a training vehicle. *Blue Envoy* would be the first effective air-defence missile. A 1955 study into future requirements beyond 1958 stated that, until Stage 2 was fully implemented, the manned interceptor would remain the predominant defensive weapon. The development of manned fighter aircraft might have to continue well after 1963, possibly until 1970. However, it was still perceived as a matter of "when" the missile would replace the piloted interceptor, rather than "if".[23]

Recruitment issues

Under its own steam, the RAF was already looking at its plan to become a predominantly unmanned force, the recruitment implications of which were seriously considered. There was a fear that, without the thrill of actually being able to fly, the RAF would lose much of its attraction. There was still an element of glamour about being a pilot and fighting in the air. In the brave new world of guided missiles, air warfare as such might be perceived as having ceased to exist.

Air Vice-Marshal the Earl of Bandon, responsible for RAF training, believed that future recruits would need some re-educating. Air warfare of the future would not cease to exist when aircrews were no longer required; indeed it would become more sharply focused, more critical "and will increasingly dominate all warfare until the issue of the war in the air will, in the end, decide the fate of nations".[24] Assistant Chief of the Air Staff (Operations) during 1953–55, AVM Laurence Sinclair thought the advent of guided missiles might actually increase recruitment. If the guided missile was sold as the weapon of the future, at least one of the biggest hindrances to recruitment would be overcome: "Mum and her fear of jets".[25]

Until missiles' guidance systems were perfected, pilots would still be required. The experimental English Electric Lightning was

turned into a fully operational fighter, "in which the human pilot will be acting as a directing brain mounted in, and a part of, a highly developed form of guided weapon".[26] To achieve the altitudes Mach-2 Soviet bombers would be flying at, rocket power would be needed, which led to the development of the Saunders-Roe SR.177 and the OR.329 programmes (see panel opposite). The selected OR.329 fighter was supposed to enter service by 1960, but this might be the last manned RAF fighter. "It is accepted that the ultimate solution to the defence of the United Kingdom is the SAGW", an early draft of the Operational Requirement proclaimed in 1953.[27]

Frederick Brundrett already doubted that OR.329 was worth having. He did not think it would be effective against Mach-2 bombers, and in any case the latter would soon be replaced by ballistic missiless.[28] Indeed, there did not even seem much point in the SAGW that was supposed to replace OR.329.[29] Even the Air Ministry was coming round to this way of thinking. Vice-Chief of the Air Staff during 1953–57, Air Vice-Marshal Ronald Ivelaw-Chapman was already admitting there was a strong case for not embarking on the "Stage" air-defence systems at all. As, in the new thermonuclear age, only a 100 per cent success rate meant anything — and this was almost impossible to achieve — there seemed little point in wasting money trying. Reducing expenditure on all air-defence projects would, at a stroke, solve the defence-budget crisis. This might mean admitting to the public that defence against the hydrogen bomb was impossible, but, he suggested, they were going to find this out sooner or later anyway, if indeed they had not worked it out already.[30]

Mix and match

Under pressure from the Treasury to reduce costs, the Air Ministry was already planning to run down aircraft strength within Fighter Command. Beyond 1965 Stage 1¾ SAGWs would become the principal component of the air-defence system, supported by 100 OR.329 fighters.[31]

Harold Macmillan at the Treasury wanted to go much further. In June 1956 he circulated a note suggesting that Fighter Command could not achieve its purpose in a nuclear war, had no part to play in any other types of war and could not do anything to stop a ballistic missile attack. It therefore scarcely justified the £1bn it was likely to consume over the next ten years. He conceded that the Royal Navy needed a fighter with which to defend the fleet and that the RAF might need a fighter for use overseas. He even suggested that the RAF might need to develop an entirely different type of fighter. However, he did not see the point of short-range fighters designed to

LAST OF THE DEDICATED BOMBER-KILLERS

The OR.329 / F.155 contenders

ISSUED BY THE Air Ministry in mid-1954, Operational Requirement 329 outlined what the Air Staff wanted from the next generation of interceptor aircraft, and Specification F.155 detailed how this requirement should be met. The demands of F.155 included the following:

- the ability to intercept an enemy bomber flying at Mach 1+ within 20min of target contact (approx 250 miles — 400km — from the UK);
- a service ceiling of at least 60,000ft (18,000m);
- the ability to carry armament of a mixture of infra-red homing and radar-guided missiles;
- a crew of two; pilot + weapons officer/navigator.

Thus the result would have to be a rapid-climbing Mach 2+ interceptor capable of carrying at least two collision-course missiles, and which would eventually replace the English Electric P.1B Lightning. Engine manufacturers also set about developing new powerplants for this new generation of fighters, including de Havilland (Gyron/Gyron Junior) and Rolls-Royce (RB.106).

Ten designs were put forward for F.155, but none proceeded beyond the design stage, the 1957 Defence White Paper sounding the death knell of the dedicated bomber-killer. The ten were:

Avro Canada CF-105 Arrow Added to F.155 towards the end of the process, the Canadian Arrow was essentially a stopgap to cover probable delays in the Fairey Delta 3 project (see below).

Avro 729 Little appears to be known about the Avro 729; it was described variously as a single-Gyron-powered all-weather fighter and a twin-engined canard design, as seen opposite.

Vickers-Armstrongs (Supermarine) Type 559 This canard design with a large air intake beneath the cockpit for its twin Gyrons, one atop another, as on the P.1, was to carry a pair of *Red Hebe* missiles on dorsal pylons. Deemed too radical.

de Havilland D.H.117 Powered by a pair of Gyron Juniors and a D.H. Spectre booster rocket in the tail, the straight-winged D.H.117 was deemed not radical enough, and certainly not enough of an advance on the P.1B Lightning.

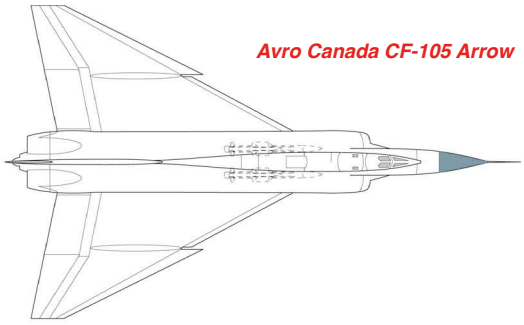
Fairey Delta 3 Based on research undertaken with the Delta 2 (F.D.2), Fairey submitted two designs to F.155; a large twin-Gyron-engined *Red Hebe*-carrying version that would meet the full spec, and a smaller, less ambitious single-engined version that would be easier to develop. The large version was selected by the MoS and Air Staff.

Armstrong Whitworth AW.169 With a pair of Gyron Juniors in nacelles fitted to a razor-thin straight trapezoidal wing, the T-tailed AW.169 would carry *Blue Vestas* on its wingtips.

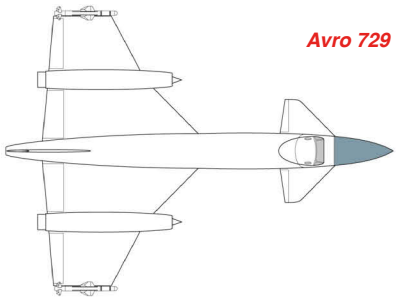
English Electric P.8 A much modified and larger Lightning fitted with *Red Tops* on its wingtips, this was considered insufficient advance on the P.1B.

Saunders-Roe P.187 A development of the company's SR.53 and SR.177 mixed-power concepts, the P.187 was too big from the outset.

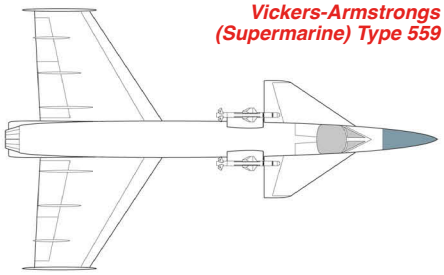
Hawker P.1103 This was to be powered by a single Gyron, with detachable rocket boosters mounted mid-wing and *Red Hebes* on its wingtips.



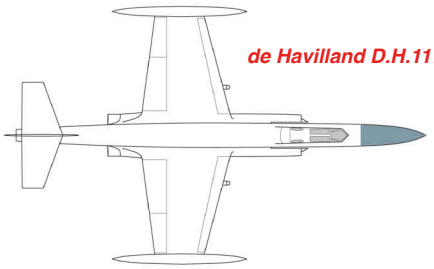
Avro Canada CF-105 Arrow



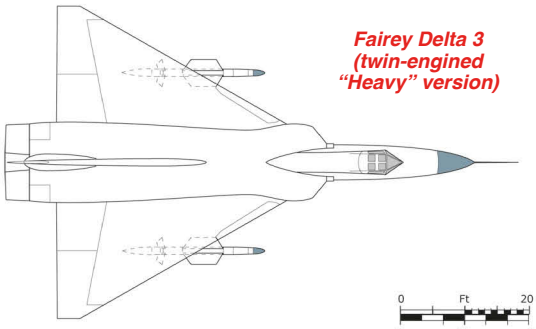
Avro 729



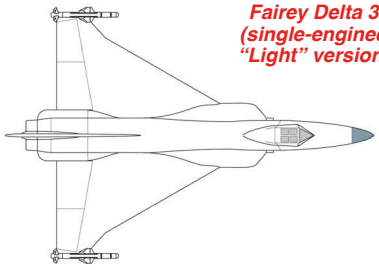
Vickers-Armstrongs (Supermarine) Type 559



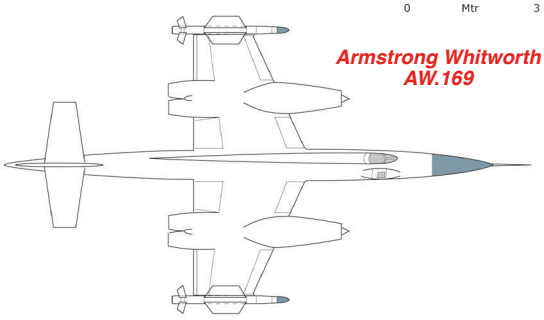
de Havilland D.H.117



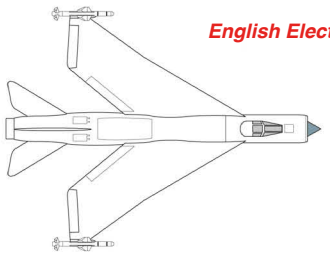
Fairey Delta 3 (twin-engined "Heavy" version)



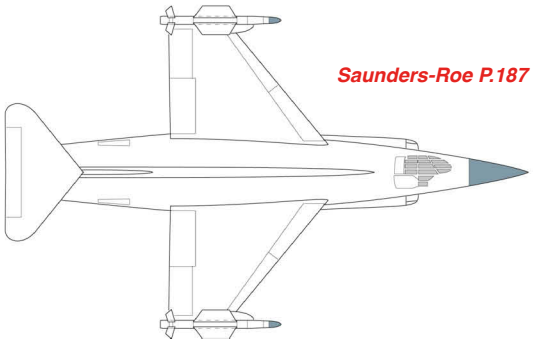
Fairey Delta 3 (single-engined "Light" version)



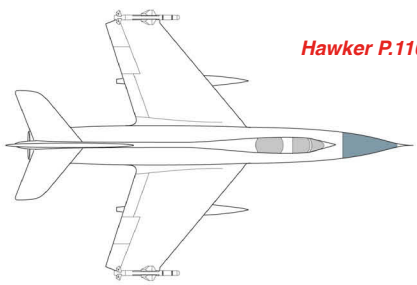
Armstrong Whitworth AW.169



English Electric P.8



Saunders-Roe P.187



Hawker P.1103

Artwork by CHRIS GIBSON © 2017

TAH ARCHIVE

ABOVE ***Powered by an Armstrong Siddeley Screamer rocket for take-off, and the same company's Viper turbojet for its return to base, the Avro 720 was designed to fulfil OR.301 of 1952 for a mixed-powerplant interceptor. One airframe, given the serial XD696, was nearing completion when the 720 programme was cancelled during 1955–56.***

intercept Soviet bombers, that very soon would be replaced by ballistic missiles. Nor did he see any need for the SAGW defences that were supposed to replace the manned fighter.[32]

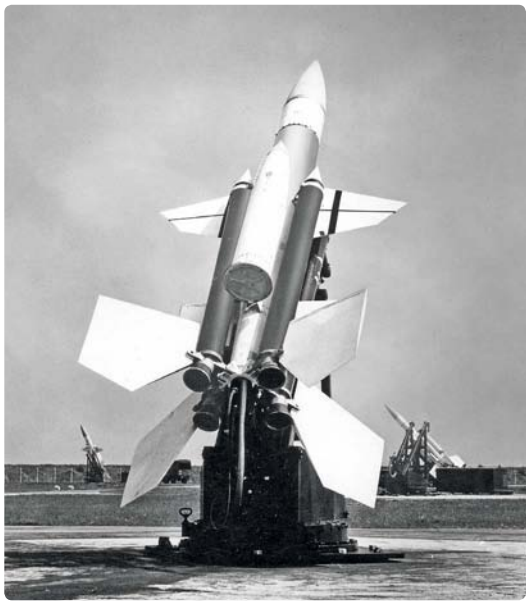
The Air Ministry was outraged that the Navy seemed to be getting preferential treatment, but Macmillan was not against manned fighters. He simply did not see the need for short-range rocket-powered interceptors. There were countless valid arguments for retaining a manned-fighter force, but the Air Ministry, consumed by an obsession with nuclear conflict, was simply unable to come up with them. By its own logic, the case for the manned fighter was flimsy, and this was apparent in the arguments it presented. Conventional air defences, it argued, could not be abandoned on the basis of the possible introduction of a new weapon at some future date. The ballistic missile might face all sorts of unforeseen difficulties, which might delay its introduction or reduce its usefulness.[33] The missile might not have the accuracy to hit V-bomber bases in the UK, so the enemy might have to attack these with manned bombers. Rather desperately, it was claimed that only by Britain persevering with an air-defence programme would the Soviet Union be compelled to make the expensive commitment to develop expensive high-performance bombers and ballistic missiles.[34] The Air Ministry was missing more obvious and much stronger arguments.

Arguably, Macmillan saw the need for a manned fighter force more clearly than did the Air Staff. In February 1956 the Chancellor had actually reminded the latter that there was a case for an RAF fighter force supporting operations overseas, and with the growing crisis over the Suez Canal this was a very real possibility. But the Air Ministry felt little could be made of this.[35] There were doubts that it would be practical to deploy rocket-powered fighters overseas and in any case, ultra-short-range interceptors were not what would be required. Even the Lightning did not have the necessary endurance. For such a role a completely different fighter would be required, with much greater range and entirely different radar equipment.

For its part, Fighter Command, struggling for its very existence, was producing some much more convincing arguments. The Soviets might launch stand-off missiles from outside the range of the SAGWs, and a fighter that could help break up attacks before the SAGW defence-zone was reached would be useful. An even stronger argument was that the SAGW offered only two options, one active and one passive; shoot down the approaching aircraft or do nothing. There would always be a need for a more flexible manned interceptor to investigate an intruder.[36] However, these were arguments for a different sort of fighter, with greater endurance, more like the sort of aircraft that would be required to operate overseas. This was not an argument for the ultra-short-range rocket-powered interceptor.

A new broom

In January 1957, when Macmillan took over the premiership in the wake of the Suez fiasco, he appointed Duncan Sandys as his Minister of Defence, with instructions to undertake a programme of reforms he felt was long overdue. This included abandoning any attempt to defeat a nuclear attack and relying on the nuclear-armed ballistic missile as a deterrent. The Air Staff had to agree that the government was right. "Whenever an operational problem can be precisely defined, an unmanned system is likely to be best", the Operational Requirements department concluded in February 1957.[37] Once ballistic missiles



TAH ARCHIVE

LEFT ***A battery of Bloodhound Mk Is on their launchers at RAF North Coates, Lincolnshire, Britain's first guided-weapons air defence station. The 1957 Defence White Paper went through some 13 "final" versions, historian Peter Hennessy later remarking that there was "blood on every page . . ."***

arrived, "the manned bomber [was] dead [as a concept] against Russia".[38] The Air Staff also agreed that "the contribution which future manned fighters could make is insufficient to warrant their development", and that resources should be switched to the development of SAGWs.[39] The Air Staff could see no justification for keeping the SR.177 and OR.329 mixed-powerplant fighters, or the OR.330 supersonic bomber. These manned combat aircraft could go, but it still wanted to keep the ground-to-air missiles.

Macmillan and Sandys wanted to go further. The SR.177 and OR.329 interceptors would go, but so would the *Blue Envoy* surface-to-air missile. Sandys was showing no preference for the missile over the manned interceptor. It was air-defence against nuclear-bomber attack that was going, not the manned fighter. The Lightning interceptor and the Bloodhound SAM were so close to deployment it was decided that the delivery of these might as well go ahead. Manned and unmanned systems were being dealt with in exactly the same way.

Sandys, however, was to pay the price for the spin the government put on the new policy. The official government line for public consumption was that a more modern approach to warfare was being adopted with the missile replacing the obsolete aeroplane. The deployment of the modern-looking Bloodhounds was particularly useful for projecting this image. Much was made of the fact that the Lightning would be the last manned fighter. The cancellation of Bloodhound's successor received rather less attention. It was a public-relations triumph for the government. Unfortunately for Sandys, this rather convenient way of presenting the policy would forever be associated with his name.

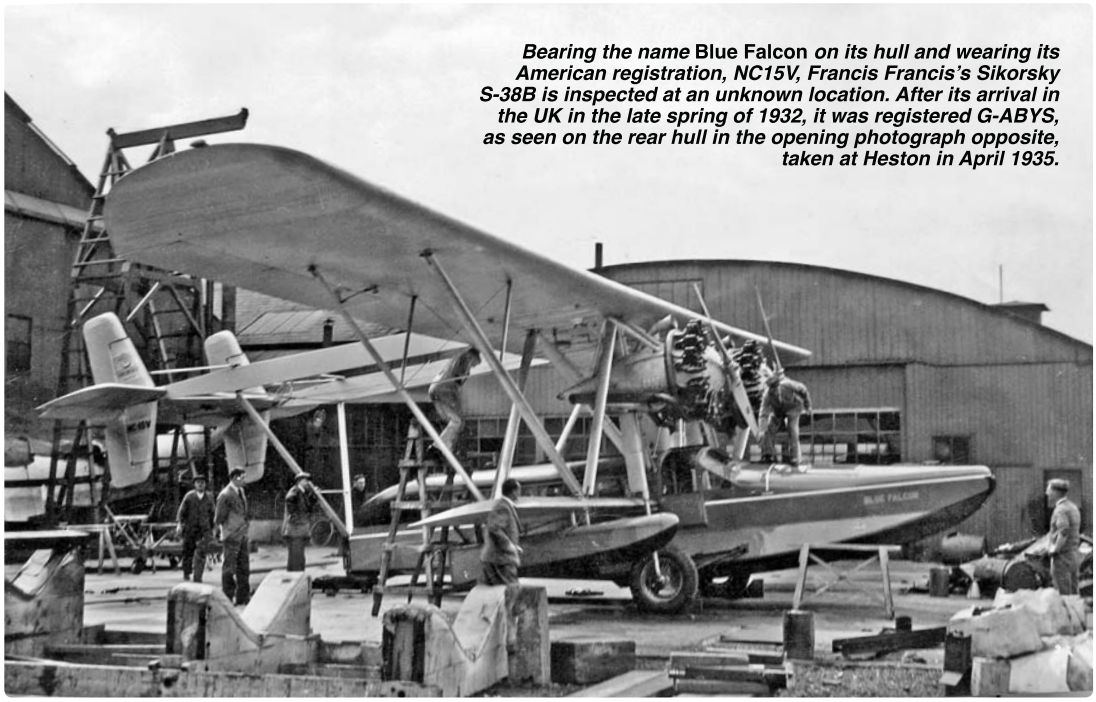
The Air Staff's obsession with all-out nuclear war had blinded it to the need for manned aircraft. With time, the arguments for manned combat aircraft would become clear enough. The Air Staff might claim that this was what it was saying all along. The truth is that it had not come up with any of these arguments at the time. The Air Staff genuinely believed that the unmanned approach was the way to go. It did not consider what might be needed in conventional conflicts. As it turned out, these would become the norm, not nuclear wars, and manned combat aircraft would indeed be required. The Air Staff had got it wrong. With hindsight, it was a rather embarrassing misjudgment — but there was always Duncan Sandys to blame.

1 The National Archives (TNA) ref AVIA 65/1868, July 1936; AVIA 65/1868, 6.7.37; SUPP 6/510, 3.10.36, 5.10.36, 26.11.36; AIR 20/382, May 1936
2 TNA ref AVIA 7/1518, July–October 1941
3 Harris, Sir Arthur, *Bomber Offensive* (Collins,1947), p216
4 TNA ref CAB 126/257, 21.8.45
5 TNA ref AVIA 54/772, 22.9.45
6 TNA ref AVIA 48/2, October 1946
7 TNA ref AVIA 6/14775
8 TNA ref AIR 75/24, 19.9.50
9 TNA ref AIR 5/50; AIR 2 /1346; CAB 16/67, 6.5.25 & 24.3.28; AIR 20/382, 30.11.33; CAB 16/132, 25.7.35
10 TNA ref AVIA 7/251, 23.10.40
11 TNA ref AIR 20/11387
12 TNA ref AIR 9/177, 29.9.45
13 TNA ref AIR 20/11387, 14.10.48; AIR 20/548
14 TNA ref AIR 20/6721, 13.6.50 & 19.7.50
15 TNA ref AIR 20/11387
16 TNA ref AIR 20/9208; AIR 8/2474, 4.52; AVIA 65/20
17 TNA ref AVIA 13/1234, 23.7.53
18 Hill, C.N., *Vertical Empire: The History of the UK Rocket & Space Programme 1950–71* (Imperial College Press, 2001), p71
19 TNA ref AIR 20/7723, December 1954
20 TNA ref AIR 20/9902, April 1955
21 TNA ref AVIA 65/906, 20.4.55
22 TNA ref AVIA 54/2045
23 TNA ref AIR 20/9902, 21.6.55
24 TNA ref AIR 20/9901, 7.1.54
25 Ibid
26 Ward to Parliament, CAB 129/86, 10.3.58
27 TNA ref AIR 2/15106, 31.10.53; AIR 20/7395, 3.54
28 TNA ref DEFE 13/17, October 1954
29 TNA ref DEFE 13/43; AVIA 13/1234,
30 TNA ref AIR 20/11154, 21.5.54
31 TNA ref DEFE 7/1128, 5.4.56
32 TNA ref AIR 8/2014, 11.6.56
33 TNA ref AIR 8/2014
34 TNA ref AIR 20/9774, February 1956
35 Ibid
36 TNA ref AVIA 65/94, March 1956
37 TNA ref AIR 20/7723, 19.2.57
38 TNA ref AIR 20/7723, 20.2.57
39 TNA ref AIR 2/13418, 11.3.57

THE BLUE FALCON

A MILLIONAIRE AND HIS AERIAL YACHT

In 1922 the 18-year-old Francis Francis inherited a fortune from his grandfather, and within a decade had become an army captain, been chosen to represent Britain in the Olympics and married an American actress. He had also acquired a passion for aviation. **PHILIP JARRETT** reflects on Francis's ownership of a "de luxe" amphibian



Bearing the name* Blue Falcon *on its hull and wearing its American registration, NC15V, Francis Francis's Sikorsky S-38B is inspected at an unknown location. After its arrival in the UK in the late spring of 1932, it was registered G-ABYS, as seen on the rear hull in the opening photograph opposite, taken at Heston in April 1935.

ALL PHOTOGRAPHS VIA AUTHOR UNLESS OTHERWISE STATED

IN 1922, WHEN he was 18 years old and attending Rugby School, Francis Francis and his sister Evelyn, aged 19, inherited large fortunes from their grandparents, their grandfather having been one of the founders of The Standard Oil Company. This made them both millionaires. In the succeeding years Francis gained a commission as a captain in the Royal Horse Guards (The Blues), but in 1929 he sacrificed his army career and resigned his commission after falling in love at first sight with the American comedienne and actress Sunny Jarman. Their engagement was swiftly followed by a secret wedding at Christ Church in Mayfair, London, on December 23, 1929.

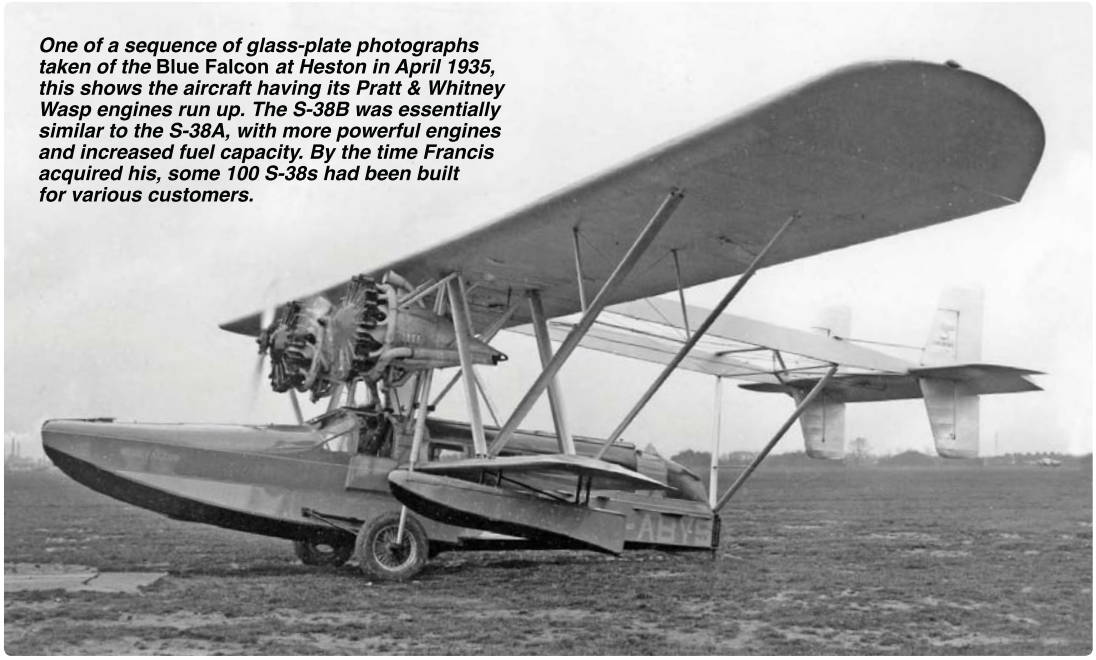
A versatile sportsman, Francis was chosen to be a member of the British Olympic team in 1928 as a fencer, horseman and 400-yards runner, but unfortunately he was prevented from competing by diphtheria. He then became an accomplished amateur golfer, winning the Swiss Open Championship in 1936 and becoming Dutch Amateur Champion in 1935 and 1936. He also played three times for England in the Home Internationals in 1936 and against France in 1935 and 1936.

Francis could afford to indulge his interests, and flying was evidently one of them. Around 1930 he learnt to fly under the tutelage of Valentine Baker, the chief flying instructor of the flying school at Heston, and the two men quickly became firm friends. In January 1931 Francis bought Saunders-Roe A.17 Cutty Sark G-ABBC, a twin-inline-engined amphibian flying-boat. He followed this in July with Saunders-Roe A.21 Windhover G-ABJP, another amphibian, this time powered by three 120 h.p. de Havilland Gipsy II inline engines. Both machines were based at Heston. However, the Windhover was sold to Gibraltar Airways in September of the same year, and in March 1932 he sold the Cutty Sark to British Amphibious Air Lines.

A NEW AEROPLANE

Francis's affection for amphibious aeroplanes was undiminished, but his attention had been drawn to the USA. His next acquisition was a five-seat Sikorsky S-38B powered by a pair of 420 h.p. Pratt & Whitney Wasp radial engines. The S-38, which has been described as a major factor in the Sikorsky Manufacturing Corporation's eventual success, was a distinctive machine with its two engines strut-mounted between its parasol wing and the hull, and the tailplane and twin fins and rudders carried on twin booms extending behind the wing and strut-braced to the tail end of the hull.

Built in Bridgeport, Connecticut, in 1930, Francis's aircraft, c/n 314-19, described as a "de luxe" version and initially registered NC15V, was bought by Capt Francis in 1932 and named *Blue Falcon*. Francis travelled to the USA with his own mechanic, who also needed to gain familiarisation with the aircraft, and asked Sikorsky test pilot Boris Sergievsky, along with a company mechanic, to accompany him as pilot and personal instructor on a trip to the West Indies. The passengers were Mrs Francis Francis, her mother, their maid, Capt Francis's valet, one bulldog and two Pekinese.



One of a sequence of glass-plate photographs taken of the **Blue Falcon** *at Heston in April 1935, this shows the aircraft having its Pratt & Whitney Wasp engines run up. The S-38B was essentially similar to the S-38A, with more powerful engines and increased fuel capacity. By the time Francis acquired his, some 100 S-38s had been built for various customers.*

BELOW *The distinctive water tower in the background once again marks the location in this photograph as Heston. The amphibian was sometimes referred to as "The Explorer's Air Yacht", owing to its popularity with well-off private owners. Sikorsky's first real commercial success, the S-38 made its maiden flight on June 25, 1928.*

BELOW *For waterborne operations, the S-38's undercarriage was retracted by means of an ingenious system in which the rubber-tyred mainwheels were fitted to a hinged axle attached to the hull, the outboard wheel hub being attached to a telescopic tube system, which was hydraulically raised to bring the wheels parallel with the wings.*

ABOVE ***Minus its outer wings and tailbooms, the S-38 is carefully hoisted from the deck of the*** **RMS Berengaria** ***to the dock at Southampton on its arrival from the USA in the late spring of 1932. At this point it was still registered in the USA as NC15V, and there appears to be conflicting evidence about when its UK registration was applied.***

After making a number of flights around New York the group set off, making one overnight stop at Charleston, South Carolina, before arriving at Palm Beach. Sergievsky relates in his book *Airplanes, Women and Song* (Syracuse University Press, 1999) that Francis's desire to master his new aeroplane was so great that he allowed little time for rest. At Palm Beach they began practising every morning and afternoon, and within a few days there was little more that Sergievsky could teach Francis. The test pilot gained the impression that Francis was keeping him in his employ mainly for the trip to the West Indies, where Sergievsky could help with navigation and in obtaining the necessary papers, clearances and permits.

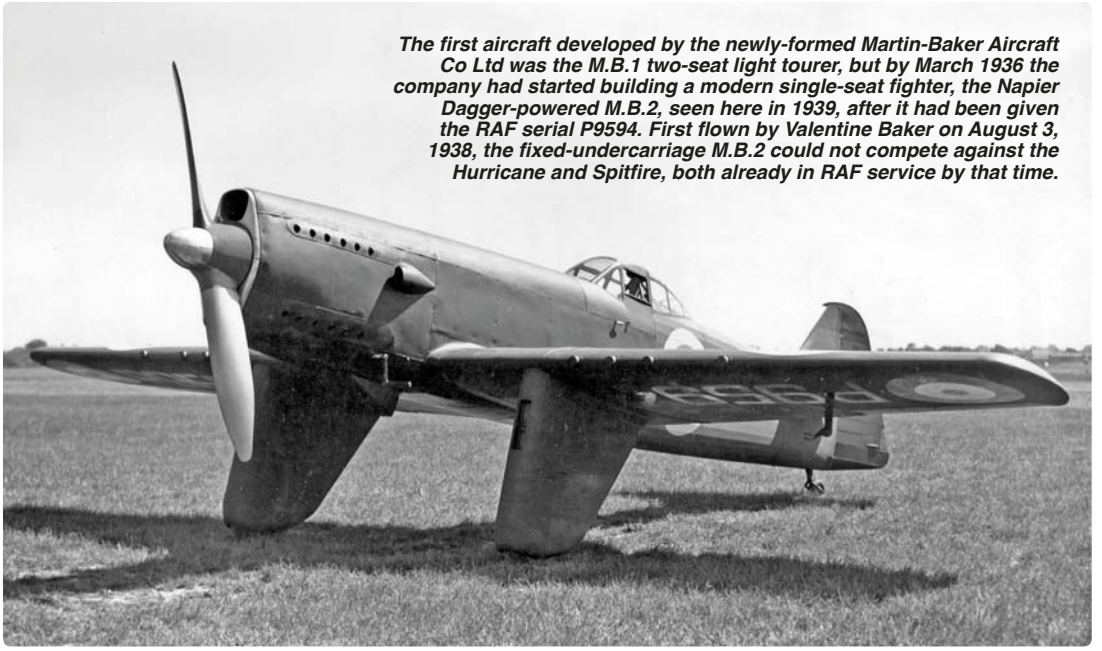
After several weeks in Palm Beach and another two at the Pan American airport in Miami, where they practised ground landings, they flew to Havana, Cuba, where after some difficulty they managed to obtain a permit to keep the S-38B at the military airfield of Campo Columbia. Cuba's President, Gerardo Machado, had passed a law specifying that all privately-owned aeroplanes were to be kept at another airport further inland that he owned, and where an "outrageous amount" was charged for storage, but Campo Columbia was very close to Havana and far more convenient for the S-38 party.

Having enjoyed the delights of Havana, the group was preparing to start for Puerto Rico when a cable arrived announcing the suicide of Ivar Kreuger, a Swedish businessman known as "The Match King". Francis had invested heavily in Kreuger's nefarious enterprises, so the matter required his immediate attention, and a man in charge of part of Francis's business interests had to meet him in Florida. Consequently a hurried return flight to Miami was made.

Sergievsky now felt that he could be of no further use to Francis, but the millionaire, who held only a British pilot's licence, was unable to pilot the *Blue Falcon* in the USA. Sergievsky therefore suggested that Francis take the examination for an American licence, and arranged an appointment for him with the government inspector in Palm Beach. After they had flown there Francis "very successfully" passed his examination, whereupon Sergievsky said that he could be of no further use to him. Francis observed that, as Sergievsky's term of employment had been much shorter than anticipated, he did not see why the test pilot should suffer financially simply because he was such a good instructor and had taught him to fly the aircraft more quickly than usual. Francis therefore asked Sergievsky to "do him the favour" of accepting a month's salary in advance. Sergievsky naturally agreed, and left the group in Miami.

BLUE FALCON TO THE UK

On May 25, 1932, the *Blue Falcon* was hoisted on board the Cunard liner *RMS Berengaria* for its transatlantic trip to the UK. When the ship arrived at Southampton the amphibian was craned ashore and then ferried to Heston on June 5. It was granted its Certificate of Airworthiness



The first aircraft developed by the newly-formed Martin-Baker Aircraft Co Ltd was the M.B.1 two-seat light tourer, but by March 1936 the company had started building a modern single-seat fighter, the Napier Dagger-powered M.B.2, seen here in 1939, after it had been given the RAF serial P9594. First flown by Valentine Baker on August 3, 1938, the fixed-undercarriage M.B.2 could not compete against the Hurricane and Spitfire, both already in RAF service by that time.

RIGHT ***The three founding members of Martin-Baker Aircraft beside the M.B.2 in 1939. From left: Capt Valentine Henry Baker, who was killed in the M.B.2's successor, the M.B.3, in September 1942; James Martin, who was so affected by Baker's death that he established Martin-Baker as the world leader in ejection-seat technology, and Francis Francis.***

on August 4, registered G-ABYS. Confusingly, it has also been recorded that NC15V flew at Le Bourget on June 4 and 8, 1932, "before leaving for a circuitous route to Geneva", where Francis had a home on the shores of Lake Geneva. The same source states that "Francis arrived [at] Heston in NC15V on August 1, 1932, and left on August 3 for Croydon in G-ABYS". Presumably the aircraft had its new British registration applied between those dates. A report dated August 23, 1932, states that Francis and his wife arrived at Heston in the *Blue Falcon* "during a world tour", so it seems that they wasted no time in putting the amphibian to good use.

The aircraft was flown to Geneva on September 3, 1932, "on delivery to R.H. Parrott", but it is on record that Francis's last surviving logbook shows a flight in G-ABYS on August 10, 1935, at which point his total flying hours in this aircraft were "987.40". The original caption to a group of original professional press agency glass negatives of the *Blue Falcon* at Heston, now in this author's collection, is dated April 8, 1935, and states that the aeroplane "belongs to Mr Francis Francis, the millionaire", so it seems that the "delivery" to Parrott did not denote a change of ownership. In February 1936 the *Blue Falcon* was sold in France and registered F-AOUC. It ended its life in a crash at Calabar, Niger Colony, on August 12, 1939.

AFTER THE BLUE FALCON

As a result of his friendship with Baker, Francis was introduced to James Martin and became involved with the latter's aeroplane project, which would eventually emerge as the Martin-Baker M.B.1. Francis provided the financial backing for the emerging company, which was incorporated as the Martin-Baker Aircraft Company Ltd on August 17, 1934. Because of his other business interests, Francis thought it inappropriate to have his name included in the company title.

When Baker demonstrated the company's new M.B.2 fighter to the press on May 26, 1939, both Francis and Sunny were present, and he continued to be involved with the company until

RICHARD T. RIDING COLLECTION

SIKORSKY S-38B DATA

Powerplant 2 x 420 h.p. Pratt & Whitney R-1340 Wasp nine-cylinder liquid-cooled piston engines

Dimensions		
Span	71ft 8in	(21·85m)
Length	40ft 5in	(12·3m)
Height	13ft 10in	(4·22m)
Wing area	720ft²	(68·6m²)
Weights		
Empty	6,548lb	(2,970kg)
Loaded	10,479lb	(4,755lb)
Performance		
Maximum speed	124 m.p.h.	(200km/h)
Cruise speed	109 m.p.h.	(175km/h)
Rate of climb	750ft/min	(230m/min)
Service ceiling	18,000ft	(5,480m)
Normal range	600 miles	(960km)

ABOVE ***Following its stint in the UK as G-ABYS, the* Blue Falcon *was sold to French airline Aéromaritime, which was established in March 1935 to provide air services in French West and Equatorial Africa. In March 1936 the S-38 completed the airline's first reconnaissance flight between Dakar (now in Senegal), Cotonou (Benin) and Pointe Noire (Republic of Congo).***

1946, providing substantial financial support.

During the Second World War Francis served in the Air Transport Auxiliary (ATA), and in July 1941 he was the Commanding Officer (CO) of No 1 Ferry Pool at White Waltham in Berkshire. Lettice Curtis, in her book *The Forgotten Pilots* (3rd edition, Nelson & Saunders, 1985), recalls that he "was slight and dark with very blue eyes and a born leader who was especially good with the roughs and toughs of the pool, whom he could get to do anything and with whom he generally got on better than with the bosses 'upstairs'". She adds that all the girls fell for him, and that she thought him wonderful.

He was known familiarly as "Frankie". He was then posted in early 1943 to become CO of No 6 Ferry Pool at Ratcliffe, Leicestershire, but on June 1, 1944, he returned to take command again at No 1 Ferry Pool. Given his pre-war experience as a pilot of marine aircraft it is no surprise that he was one of the first ATA pilots to undergo flying-boat training by the RAF at Alness on the Cromarty Firth in Scotland, which included comprehensive dual and solo flying on Consolidated Catalinas and Short Sunderlands.

After the war Francis maintained his prominent position as a leading amateur golfer. In 1958 and 1960 he was Swiss Amateur Champion, and he was a member of the British Seniors World Cup team of 1967.

Francis Francis died at his home in the Bahamas on December 24, 1982. Hugh Bergel, an ex-ATA Ferry Pool commanding officer, wrote of him: "All who served under him at White Waltham or Ratcliffe . . . knew him as a man of infinite charm, a pilot of outstanding skill and determination and a greatly liked and respected CO who always led his pilots from the front". He also says that no sooner had Francis mastered something than he started to lose interest in it and had to seek new worlds to conquer, adding: "I don't think that Frank was ever a very happy man deep down, perhaps because he ran out of new worlds while still quite young". However, his love of aviation — and golf — seems to have endured rather longer than that.

US NAVY VIA AUTHORS

AN EYE FOR AN EYE

THE LIBYAN ARAB AIR FORCE'S TUPOLEV TU-22 *BLINDERS* IN COMBAT IN CHAD, 1981–87

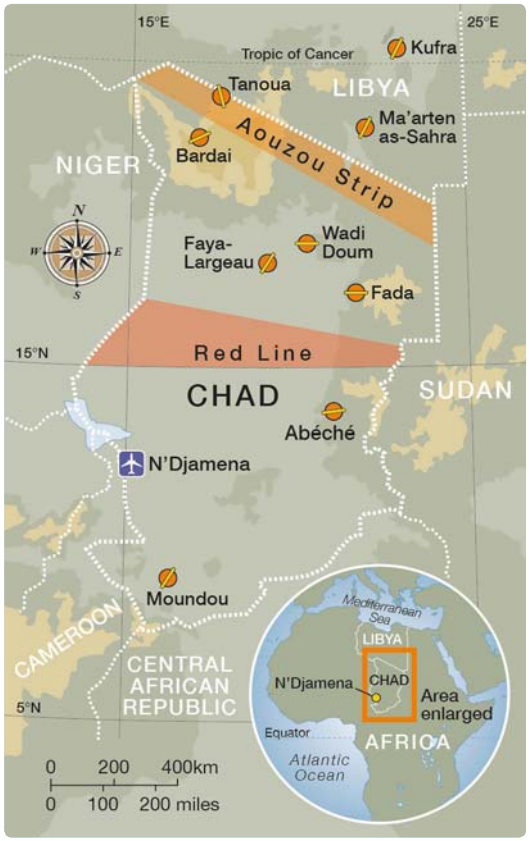
During the 1980s Libya's fleet of ageing former Soviet Air Force Tupolev Tu-22 *Blinder* supersonic bombers was regularly called on to undertake near-suicidal missions into neighbouring war-torn Chad; African military aviation specialists **ARNAUD DELALANDE** & **TOM COOPER** detail the Libyan career of one of the few Soviet bombers to see combat

MOST OF northern Africa is dominated by the Sahara, a giant desert more than 35 times the size of the UK, and which blankets nearly all of some ten countries. The climate of the Sahara is one of the world's most severe. In the summer, daytime air temperatures soar well above 38°C (100°F); indeed, the hottest air temperature ever measured — 57·7°C (136°F) — was recorded in Azizia in north-western Libya. Beneath the clear night skies, the temperatures frequently plummet below freezing in the northern Sahara, and snow sometimes falls in some of the higher mountain ranges.

The local scenery includes not only endless fields of sand dunes, but also arid mountains, plateaus, sand- and gravel-covered plains, shallow basins and large oasis depressions. The same unforgiving climate and rugged terrain also dominate most of Libya's southern neighbour, Chad, which has existed in a near-permanent state of war for more than 60 years. It is also the stage on which a major showdown between France and Libya was played out in the mid-1980s.

BORDER SKIRMISHING

A former colony in French Equatorial Africa, Chad gained independence from France in 1960, although French troops remained "in country" until requested to withdraw in 1977. In 1972, however, Libya had unilaterally occupied and annexed the so-called Aouzou Strip in northern Chad, and in 1978 launched its first invasion of the country, during which it supported the *Front de Libération Nationale du Tchad* (FROLINAT — National Liberation Front of Chad), an insurgent group active in the Tibesti mountain range in the north of the country. France rushed to support the official Chadian government in the capital, N'Djamena, with Operation *Tacaud* in April 1978.



Although successful, the French forces were requested to leave again only a year later, thus paving the way for a second Libyan intervention.

In 1981 Libyan troops and allied Chadian insurgents drove to N'Djamena, where they removed the government after a pitched battle. However, the Tripoli-supported *Gouvernement d'Union Nationale de Transition* (GUNT — Transitional Government of National Unity) fell apart in 1982, and the country's new rulers requested help from France again. Accordingly, in 1983 Paris sanctioned Operation *Manta*.

As of 1984, Chad was split in two. The part of the country north of the 16th Parallel — a "Red Line" was drawn between the 15th and 16th Parallels — was placed under Libyan occupation. South of the line was under the control of the government of Hissene Habré, supported by French troops. Following extensive and troubled negotiations, Paris and Tripoli agreed to a mutual withdrawal. However, while all French troops had left the country by the end of 1984, the Libyan forces had merely scattered and gone into hiding in the vast expanses of the Sahara, constructing a number of well-fortified military bases.

It was against this backdrop that the Libyan Arab Air Force's Soviet-supplied Tupolev Tu-22 bombers flew some of the type's last combat sorties, during which they clashed with some of France's most advanced air-defence systems.

LEFT ***The somewhat fluid borders of Libya and Chad during the 1980s. Map by MAGGIE NELSON.***

OPPOSITE PAGE ***A McDonnell Douglas F-4 Phantom of US Navy unit VF-51 intercepts one of the Libyan Arab Air Force's Tu-22* Blinders *over the Mediterranean during the latter's delivery flight in April 1977. Note the red, white and black Egyptian-style roundel and fin flash used by LAAF aircraft during 1969–77.***

LIBYA'S BLINDERS

During the 1970s Libya had become involved not only in Chad, but also in the ongoing Arab-Israeli conflict and elsewhere. The Air Staff of the Libyan Arab Air Force (LAAF) thus concluded that it had a requirement for a supersonic medium bomber with a range of more than 1,000km (620 miles), and in 1976 Tripoli placed an order with the Soviet Union for 14 Tu-22s, Nato reporting name *Blinder*. According to Iraqi sources, this was the result of an agreement between the Iraqi government in Baghdad and the Libyans in Tripoli, in which both Iraq and Libya would buy supersonic bombers that could bomb targets in Israel, continue on to air bases on the "other side" of Israel, re-arm, and then bomb again while returning to their original bases. Combined with electronic warfare, such tactics would ensure a high standard of safety of operations for Iraqi and Libyan Tu-22s.

Slightly longer and significantly heavier than a modern Airbus A320, the Tu-22 could reach Mach 1·5 at altitude while carrying either a standard bombload of 3,000kg (6,610lb), or an "overload" of up to 9,000kg (19,840lb) of bombs. Such performance, however, came at the price of complex maintenance and a severely overtasked crew, especially the pilot. The two Dobrynin RD7-M2 turbojet engines were not only particularly thirsty — usually using some 2,000lit (440gal) of fuel just to warm up before flight — but, positioned high above the fuselage, also proved hard to maintain. They were also very sensitive to the effects of sand and scrub. The engines caused numerous headaches for the pilot, who had to make very precise throttle movements. Any mistake or mishandling during high-speed flight would invariably lead to an engine malfunction, often resulting in disintegration of the airframe.

Although offering impressive performance for an aircraft of its size and weight, the Tu-22 proved difficult to fly, even for the most experienced Soviet pilots. It was notorious for its high landing speed, some 310km/h (192 m.p.h.). The braking parachute was vital; its loss or malfunction usually meant the loss of the aircraft and in all likelihood the crew, as the Tu-22 was equipped with downward-firing ejection seats, and there was no way of stopping a Tu-22 by the end of even the longest of runways using brakes only.

To make matters worse for the Libyans, the examples sent by Moscow were Tu-22RD *Blinder-C* reconnaissance variants manufactured for the Soviet Air Force in the early 1960s. Their

Originally designed as a supersonic intercontinental bomber and missile carrier, the prototype Tu-22 made its maiden flight on June 21, 1958. Despite its science-fiction looks, the type was always a handful to fly and a comparatively small number, just over 300, was built. Fitted with state-of-the-art camera equipment in the nose, this is a reconnaissance variant, Nato codename* Blinder-C*.

PHILIP JARRETT COLLECTION

reconnaissance equipment was removed and they were overhauled before delivery, but showed their age throughout their service with Libya.

Libyan crews selected to fly the type underwent conversion courses at Zyabrovka and Savostleyka in the Soviet Union during 1976. The first three Libyan Tu-22-pilots are thought to have been Col Masood Mathelon, Capt Akil Za'atari and Lt Mohammad Kabalan. Reportedly, their Soviet instructors were less than impressed by their performance, mostly rating them only as "fair", and decrying their lack of aggression and flying skills. Indeed, the Soviet instructors quickly concluded that Libyan Tu-22 crews would be barely capable of executing even short-duration missions on the type, and that their operations would always be driven by the desire simply to survive the flight rather than complete the operational task at hand. Although the Libyans remained dependent on Soviet assistance to operate the type well into the 1980s, they were to prove the Russian instructors wrong before long.

In 1979 a pair of *Blinders* flew the type's first LAAF combat sortie in support of Idi Amin's Uganda against northern Tanzania, during the so-called Kagera War. At the time the LAAF had one fully operational Tu-22 unit, No 1111 Sqn, based at the newly-constructed al-Jufra/Hun Air Base (AB) in central Libya. Here two *Blinders* were kept on near-permanent alert, fully fuelled and loaded with three 1,500kg (3,305lb) FAB-1500M54 bombs, ready to strike selected targets at short notice.

In 1981 Libyan *Blinders* played a dominant role during the second Libyan intervention in Chad, and also bombed a number of Chadian insurgent bases in neighbouring Sudan.

By 1985 No 1111 Sqn was maintaining regular forward-deployed detachments at Ukba Ibn an Nafi and Ma'arten as-Sahra ABs in western and southern Libya respectively, but also at forward bases inside Chad. Originally, the French-constructed airfield at Faya-Largeau was the largest in northern Chad — but, with only a dust runway, it was unsuitable for the operation of fighter jets, heavy transports or jet bombers like the Tu-22. Furthermore, it was vulnerable to surprise attacks from the south. Therefore, during 1984–85, the Libyans constructed a huge airbase near the oasis at Wadi Doum, about 155 miles (250km) north-east of Faya-Largeau, and another, Tanoua, within the Aouzou Strip.

THE "DESERT AIRCRAFT CARRIER"

Completed in early 1985, Wadi Doum AB, with its 3,800m (12,460ft) runway made of sand, hardened by crude oil and covered with an aluminium grid, became the centrepiece of Libya's deployment inside Chad. Protection for what became famous as "Libya's aircraft carrier in the desert" included two early-warning radar stations and a complete air-defence brigade, comprising one SA-6, one SA-8 and one SA-9 surface-to-air (SAM) site, six ZSU-23-4 23mm self-propelled flak guns and a battery of towed ZPU-4 14·5mm-calibre quadruple anti-aircraft machine-guns. The LAAF maintained regular detachments of its Dassault Mirage F1 interceptors and MiG-23 *Flogger-H* fighter-bombers at Wadi Doum.

Because of its concerns about Libya's Tu-22s, but also because it did not trust Tripoli's promise to withdraw from Chad, the French *Armée de l'Air* (AdA) undertook a series of reconnaissance sorties over Chad in 1985. As part of Operation *Musaraigne*, some of these sorties were flown

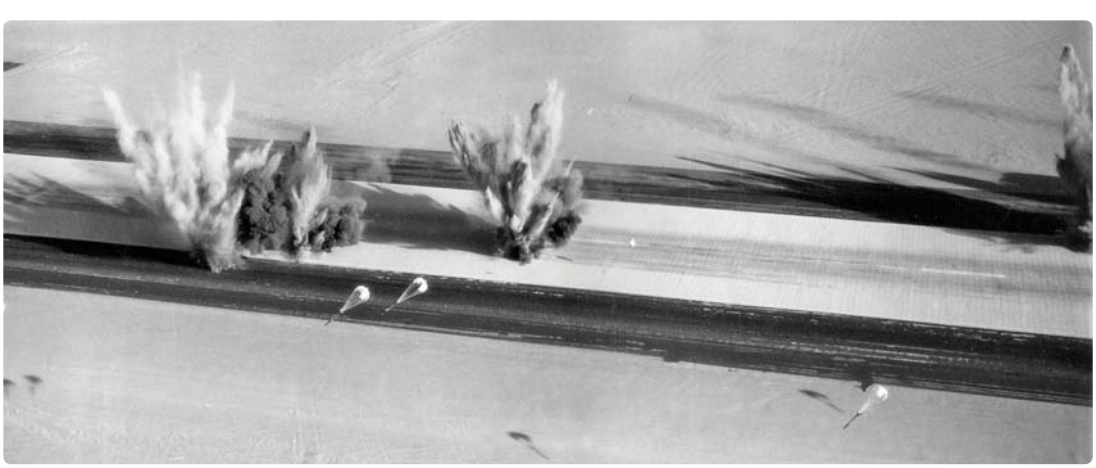
**BELOW Armée de l'Air *Sepecat Jaguar "A 89" (coded 11-MM) of* Escadron de chasse 2/11 *"Vosges" at N'Djamena International Airport with a freshly applied coat of desert camouflage and carrying a pair of 125kg* Société des Ateliers Mécanique de Port-sur-Sambre *(SAMP) bombs on the starboard underwing pylon.* BOTTOM *A dramatic photograph of French BAP-100 bombs hitting the runway at Wadi Doum on February 16, 1986, when Jaguars launched a strike on the important Libyan air base.*

ROBERT JEANTRELLE VIA AUTHORS

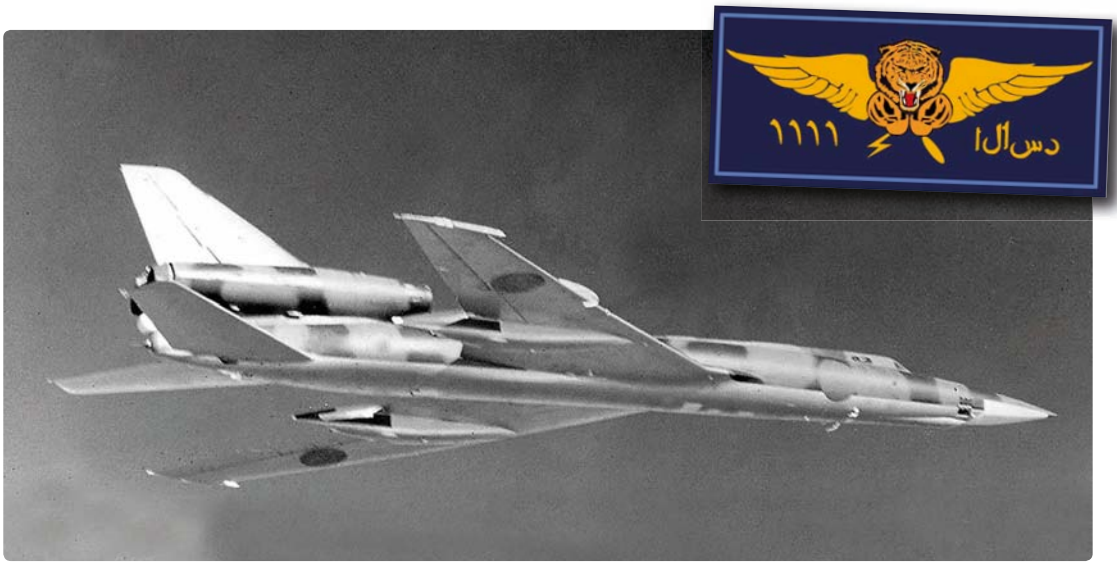
by Sepecat Jaguar fighter-bombers at very low altitude, others by Mirage IV bombers at high altitude and supersonic speed. The information collected, along with intelligence from other sources, led to a clear conclusion: the Libyans were not adhering to the withdrawal agreement.

Additional sorties by the AdA's Douglas DC-8 SARIGuE (***S**ystème **A**éroporté de **R**ecueil d'**I**nformation de **Gu**erre **É**lectronique*) and Breguet Br 1150 Atlantic electronic/signals intelligence-gathering aircraft provided detailed information about the presence of Libyan SAM sites and early-warning radars. Unsurprisingly, the headquarters of the French *Force Aérienne Tactique* (FATAC — Tactical Air Force) developed several plans for air raids against the Libyan air bases in Chad, including one against Wadi Doum, codenamed Project *Pivert*, in April 1985. The French also went further than just planning; by January 1986 the AdA had deployed a total of 11 Jaguars and four Mirage F1Cs to Bangui International Airport in the Central African Republic. Their crews were extensively briefed and trained for attacks on Libyan strongholds in northern Chad. All that was required was any Libyan action that might provoke a French counter-attack.

On February 10, 1986, Libyan forces, supported by their Chadian insurgent allies, launched their fourth major offensive into eastern central Chad. Alarmed, Habré's government instantly requested help from France. Paris responded by launching Operation *Épervier* (Sparrowhawk). When LAAF aircraft — including Tu-22s — began bombing Chadian government forces in the Fada area, the AdA was ordered to retaliate. On February 16, 1986, the Jaguars, most drawn from *Escadre de chasse 11* (11th Fighter Wing), raided Wadi Doum in a spectacular fashion. Deploying



ANDRÉ CARBON COLLECTION VIA AUTHORS



US NAVY VIA AUTHORS / ARTWORK TOM COOPER

ABOVE ***The Tu-22 was known as "the flying tank" in Libyan service, not only because of its sheer size and brute power, but also because of its lack of finesse as a flying machine; it was exceptionally hard to master and fly with precision. INSET, ABOVE The squadron badge of the LAAF's No 1111 Sqn, featuring the unit's winged-tiger motif.***

BAP 100 anti-runway bombs and 250kg (550lb) general-purpose bombs from low altitude, the Jaguars rendered the crucial air base inoperative for several weeks.

The following day the LAAF's No 1111 Sqn hit back in no less spectacular fashion. Around 0700hr a lone Tu-22 sliced down the airliner corridor over Niger and Nigeria, along the western border of Chad. Using international IFF (identification friend or foe) mode, it flew undetected before descending to low altitude, accelerating to about 1,000km/h (620 m.p.h.) and turning east, in the direction of N'Djamena International Airport.

French and Chadian personnel deployed at the airport recognised the incoming threat only as the bomber was approaching the runway with its bomb-bay open, seconds before it began releasing weapons. A newly-deployed 20mm AdA flak battery opened fire, but without any effect. The *Blinder* dropped three FAB-1500M-54 bombs; two missed and one failed to detonate, but the third hit the runway about 1,970ft (600m) from its northern end, resulting in a crater some 28ft (8·5m) deep and 80ft (25m) in diameter. The bomber appeared to escape unscathed and return to its base via northern Chad, although subsequent reports have claimed that an American ELINT/SIGINT aircraft flying over Sudan at the same time intercepted a distress call from the *Blinder's* crew as it was approaching Tanoua AB in the Aouzou Strip, and that the bomber crashed before being able to land. It remains unknown, however, whether this was the Tu-22 that bombed N'Djamena airport, or another Libyan bomber that had bombed Kouba Olanga in central Chad at around the same time; nothing is known about the fate of the crashed crew.

Four AdA Jaguars were prepared at Bangui the same day for a retaliatory attack on Faya-Largeau, but the mission was cancelled before any had taken off. N'Djamena airport was not closed by the Tu-22's air strike and Mirage F1Cs and Transall transports continued using it while repairs were undertaken during the following 36 hours. Nevertheless, the Libyan air strike had caused some degree of embarrassment for the French. The fact that this strategically important location had also been overflown by a single Libyan MiG-25R *Foxbat-D* on February 18 did not improve the situation. Indeed, it is possible that another LAAF Tu-22 attempted to attack N'Djamena airport on February 19. According to Libyan sources, the bomber was detected during approach and was forced to withdraw when two AdA Mirage F1Cs were scrambled to intercept it. Curiously, French sources make no mention of this at all. *Commandant* André Carbon, one of the participants in the air raid on Wadi Doum, was at N'Djamena on the 19th, and does not recall any Libyan activity of any sort on that day:

"On February 18 I flew from Bangui to N'Djamena. In the afternoon we performed an armed reconnaissance mission to the north-west of N'Djamena. On the 19th I was at N'Djamena and I can assure you that nothing happened; or on the following days either."

Carbon's superiors were less convinced. *Colonel* Jean-Pierre Petit, commander of the French Army's *403e Régiment d'Artillery* (403 RA — 403rd Artillery Regiment) recalled:

"I do not remember exactly how I heard of the failed Libyan attack on February 19 against N'Djamena; but I am sure that it was during the preparations for the arrival of Hawk missiles in Chad on the 21st. At that time I was posted to the General Staff of the Army in Paris."

ROBERT JEANTRELLE VIA AUTHORS

ABOVE ***Dassault Mirage F1C "279" (coded 5-NK) of Escadron de chasse 1/5 "Vendée" (and wearing the "Jeanne d'Arc" fin insignia of Escadrille SPA.124, the third flight of the squadron) awaits its next sortie from N'Djamena airport. Note the Matra R.550 Magic Mk 1 infra-red homing air-to-air missile fitted to the aircraft's port wingtip.***

Concluding that the Mirage F1Cs were unable to tackle such threats as the Tu-22 and MiG-25R, the French decided to bolster N'Djamena's air defences by deploying an AdA R.440 Crotale short-range anti-aircraft missile system and a Raytheon MIM-23B I-Hawk system operated by 403 RA. These were ferried in the hold of a USAF Lockheed C-5A Galaxy during February 18–28, 1986. Both were operational by the morning of March 3, by which time the AdA had ten Jaguars, six Mirage F1Cs, one Atlantic and seven Transalls based at N'Djamena. Six more Jaguars, plus six Transalls and another Atlantic, were available at Bangui, while two Boeing C-135F tankers and two transports were forward-deployed at Libreville International Airport in Gabon.

THE LIBYAN AERIAL OFFENSIVE

Except for combat air patrols (CAPs) along the 16th Parallel, this concentration of French air-power saw little action. However, its presence was sufficient to deter Libya from launching further offensives in a southerly direction. With French troops behind them, and jet fighters securing the skies south of the Red Line, Chadian government forces launched a major offensive to liberate the north. In late December 1986 Libyan forces in the Fada area were defeated, the Chadians inflicting severe losses. When Libya reacted with multiple air strikes on the advancing Chadian columns, the French response was to curtail the LAAF's activities with a second raid on Wadi Doum.

Realising that most of the Libyan aircraft based at Wadi Doum required ground-control support in order to navigate the vast expenses of the Sahara, the French targeted Libyan radar sites. On January 7, 1987, a pair of AdA Mirage F1CRs approached Wadi Doum at very low altitude before climbing to attract Libyan attention. When a Libyan P-19 early-warning radar started "pinging", four AdA Jaguars armed with AS.38 Martel anti-radar missiles approached undetected at very low level, each firing one missile. According to French sources, this knocked out the P-19; according to the Libyans, it hit the SURN fire-control system (Nato reporting name *Straight Flush*) of the SA-6 SAM site protecting the Libyan air base.

While successful, this second French attack on Wadi Doum had a somewhat inflammatory effect, prompting Libya to order a general mobilisation and deploy reinforcements to Chad. Furthermore, the LAAF intensified its air strikes on Chadian government forces. Although some of the involved aircraft were shot down by American-supplied General Dynamics FIM-43A Red Eye and Soviet-designed SA-7 man-portable SAMs, these proved insufficient.

Suffering as many as 50 airstrikes a day while exposed in the desert, the Chadians had little option but to launch an all-out assault on Wadi Doum. The resulting attack was launched in the early morning of March 19, 1987. In two days of fighting, the Chadians defeated two brigades of the Libyan Army and destroyed or captured 89 tanks and 120 other armoured vehicles. Also accounted for were 11 Aero L-39 Albatros jet trainers (seven of which were captured intact), 12 SIAI-Marchetti SF.260 ground-attack aircraft (five intact), two Antonov An-26 transports, four Mil Mi-25 helicopter gunships (one intact), five Mi-8 transport helicopters, two intact SA-6 SAM sites, two ZSU-23-4 flak batteries and an immense amount of ammunition and supplies.

This was a catastrophe from which the Libyan military never recovered. It not only prompted an enraged Soviet Union to demand that the LAAF

VIA AUTHORS

LEFT ***Libyan MiG-25P "6716" is seen here carrying a comprehensive collection of air-to-air missiles for its interceptor role, including a pair of R-60s (Nato reporting name AA-8*** **Aphid*) on the outer pylons, with a pair of much larger R-40s (Nato reporting name AA-6*** **Acrid*) on the inners.***

BELOW ***A transporter erector launcher and radar (TELAR) vehicle for a French Crotale short-range all-weather anti-aircraft missile system stands guard at N'Djamena airport. In the background is a recently-upgraded Armée de l'Air C-135FR with turbofans.***

destroy all Soviet-designed and -built equipment left behind at Wadi Doum, but also forced Tripoli to order a withdrawal of its forces from Faya-Largeau. This crucially important oasis was liberated by the Chadians without fighting on March 27, 1987.

While the Libyan ground forces were withdrawing, however, the LAAF continued strike sorties over northern Chad, using L-39s, Mirage F1s, Sukhoi Su-22s, SF.260s, Tu-22s and even Ilyushin Il-76 transports to bomb selected targets. This air offensive continued through March, April and May and was largely unopposed. Reluctant to get drawn deeper into a war on foreign soil, Paris turned down repeated Chadian requests to provide air cover north of the Red Line.

A sole exception occurred on June 7, 1987, when pairs of AdA Mirage F1Cs flew CAPs over Faya-Largeau —Habré's birthplace — during Chadian National Day celebrations. When an LAAF Il-76 approached from the north, French pilots fired a short burst across its nose, the transport aircraft leaving the area. It was only after fierce discussions between N'Djamena and Paris, with plenty of pushing from Washington DC, that the French finally agreed to train the Chadians to use three SA-13 mobile short-range SAM systems captured from the Libyans, for the defence of Faya-Largeau. The air defences of the oasis were further reinforced with the deployment of a team armed with four launchers for FIM-82A Stinger man-portable air defence systems (MANPADs).

The French Army's *17ème Régiment du Génie Parachutiste* (17th Parachute Engineer Regiment) was based at Faya-Largeau from May 1987 under the command of *Lieutenant-Colonel* Mouton, and was responsible for the dangerous task of de-mining the outskirts of the city.

The LAAF was still very much in evidence, however, as Patrice Rombaut recalls:

"Before the first bombing by a Tu-22 on August 8, 1987, there was a preliminary flight over our

ALBERT GRANDOLINI COLLECTION

JEAN-PIERRE GABRIEL VIA AUTHORS

ABOVE ***A Mirage F1C, coded 12-YB, of Escadron de chasse 1/12 "Cambrésis" approaches an Armée de l'Air C-135FR tanker to replenish its fuel supply during a combat air patrol over Chad. It carries a Matra Magic on each wingtip, but its usual load of a pair of Matra Super 530F-1 medium-range AAMs on its inboard underwing hardpoints is missing here.***

position by two MiG-25s. Having been warned the day before, our unit was preparing for a possible air attack . . . the passage of the MiG-25s heralded the arrival of the Tu-22s a few minutes later. On the 11th, the alert was triggered around 0600hr; an Il-76 was flying over at 5,000m [16,400ft] and began to drop several pallets of parachute-retarded bombs. The next day, artillerymen of the *11ème Régiment d'Artillerie de Marine* were deployed for SAM-site protection. They were equipped with four Stinger missile-launchers."

CROSSING THE RED LINE

The Libyan aerial offensive against northern Chad intensified during August 1987, when Chadian forces attacked the Aouzou Strip, provoking a series of bitter battles, during the course of which important positions changed hands several times. The LAAF now not only regularly bombed Faya-Largeau, but also Ounianga Kébir and even Kouba Olanga, south of the Red Line.

Paris sent warnings to Tripoli, but to no avail; the air raids continued. Eventually, the Chadians decided to take the war to the enemy with an assault on Ma'arten as-Sahra, the oasis location of the newly-constructed air base some 55 miles (90km) beyond the Libyan border, and the primary LAAF base for operations in Chad.

On September 5, 1987, a force of 2,000 Chadians driving Toyota LandCruisers overran the Libyan air base, not only killing about 1,700 Libyan military personnel and capturing another 300, but also destroying 22 aircraft, including four L-39s, six MiG-21s, four Mirage F1s, five Su-22 *Fitters*, two SF.260s and a Mi-25 helicopter gunship.

If defeats at Fada and Wadi Doum shocked the Libyan leader, Muammar Gaddafi, the raid on Ma'arten as-Sahra left him stunned. Stubborn as always, he refused to accept that the war was lost and ordered a large-scale counter-offensive, to include additional air strikes and possibly even the deployment of chemical weapons. The French intelligence services received corresponding warnings, and all French forces in Chad were put on high alert on the morning of September 7.

At around 0400hr that morning two AdA Mirage F1Cs took off for a CAP sortie over N'Djamena. They were followed by two more, an Atlantic and a C-135FR tanker shortly afterwards. The I-Hawk SAM site was also put on alert. At around 0655hr local time, the Chadian Centaure early-warning radar detected an unknown aircraft in Nigerian airspace approaching at high speed to within 55 miles (90km) and not responding to IFF interrogations. Mirage F1Cs were vectored to intercept it, but, while approaching their target, found their radars disturbed by electronic countermeasures. Ground control ordered the pilots to disengage and keep their distance. Instead, the task of intercepting the intruder was forwarded to the HQ of 403 RA's I-Hawk site.

The incoming aircraft was an LAAF Tu-22 approaching along the same route as that taken by the *Blinder* that had cratered the runway of N'Djamena the previous year. As soon as the fire-control radar of the French SAM site locked on to it, the big Tupolev descended to 4,000m (13,100ft) and accelerated to 540kt (1,000km/h). To avoid possible attack by anti-radar missiles, the French turned off the TACAN (tactical air navigation system) emitter and Centaure radar, while activating the AN/TPS decoy-radar emitter.

At 0657hr the Centaure radar was switched

VIA AUTHORS

ABOVE ***One of 12 MIM-23B I-Hawk surface-to-air missile sites operated by the* 403e Régiment d'Artillery *(403 RA) around the perimeter of N'Djamena airport, complete with hastily arranged sunshade to offer at least some respite from the African sun. The unit was responsible for the downing of an LAAF Tu-22* Blinder *on September 7, 1987.***

on again and the AN/TPS decoy turned off. The radar picture cleared and the French realised that the Tu-22 was now only eight miles (13km) away and entering Chadian airspace while aligning with the runway of N'Djamena airport. At this point the first unit of the I-Hawk site was ordered to open fire. Its fire-control radar switched into high-power illumination mode and the nearest missile launcher was ordered into action — but nothing happened. A technical malfunction swung the launcher in the wrong direction. The crew quickly switched to the second unit, which fired one I-Hawk.

Aware of the incoming threat, the Libyan pilot took evasive action while deploying chaff and flares. The SAM was faster, however, and impacted the rear fuselage of the bomber as it charged through thin cloud cover at about 3,300ft (1,000m) with its bomb bay open. A powerful explosion ripped the Tu-22 into three large parts, which crashed in flames a short distance outside the French Army's Camp Dubut. All three Libyan crew members were killed.

THE ABÉCHÉ STRIKE

Meanwhile, a similar drama was unfolding over Abéché, in eastern central Chad, at the site of a newly-constructed French military airfield. The airfield was protected by an AdA Crotale SAM site, a Stinger team and a number of 20mm flak batteries, the crews of which were as alert as those in N'Djamena. However, the local Centaure radar had been unserviceable since the previous day, significantly degrading the low-altitude detection capability of the French defenders. The snag had been reported by radio to N'Djamena the previous day and it is possible that the Libyans were aware of it, hence the attack. Furthermore, the Stinger and flak crews were blinded by the sun, and had difficulty acquiring a target on which to open fire.

The Libyan crew flew the *Blinder* at low altitude and made excellent use of the surrounding hills to conceal the bomber's approach before starting the bombing run with the sun behind them. The aircraft was thus only detected when nine miles (15km) away, thundering in at 620 m.p.h. (1,000km/h) at an altitude of 1,500ft (450m), already aligned with the runway axis for a perfect bombing run. The Crotale site went into action and acquired the target with its TV system. The order to open fire was issued as the bomber was passing and thus approaching the minimal engagement range of 1,000m (3,300ft).

The first Crotale missile followed an erratic course before self-destructing. The second began pursuing the target, prompting the pilot to

When the Federation of Arab Republics was disbanded in 1977, new national insignia were adopted by the LAAF, comprising a plain dark green flag and roundels, as seen here. This Tu-22 is shown with a FAB-1500M-54 bomb, as carried by LAAF* Blinders *on strikes against N'Djamena and Abéché on September 7, 1987. Artwork by TOM COOPER © 2017

ALBERT GRANDOLINI COLLECTION VIA AUTHORS x 2

ABOVE LEFT ***Locals inspect the wreckage of the*** **Blinder** ***shot down by 403 RA during the LAAF bombing sortie on N'Djamena in September 1987.*** **ABOVE RIGHT** ***One of the three FAB-1500 bombs carried by the Tu-22; it was not armed when the bomber was hit, so the French recovered it from the wreckage and put it on display at their HQ.***

descend slightly while his navigator fired at the SAM with his 23mm tail-mounted cannon. The deployment of chaff and flares proved far more effective and the Crotale exploded harmlessly behind its target, allowing the pilot to increase altitude slightly before releasing the bombload. The Tu-22's evasive manœuvring had spoiled its aim, however; the FAB-1500M-54 bombs missed the runway and fell into empty desert, causing only minor damage to one of the newly-constructed hangars.

Meanwhile, a third missile was airborne and zooming in on the departing bomber. This also failed to strike the aircraft, however, as did the fourth, fired from a range of 8,200ft (2,500m) as the bomber accelerated away, leaving the skies over Abéché criss-crossed with smoke trails. The airfield remained operational, and later the same day four Mirage F1Cs were deployed to bolster its defences.

Two days after the September 7 airstrikes on N'Djamena and Abéché, a French team of SAM specialists was deployed to Faya-Largeau to help speed the working-up process of the Chadian SA-13 SAM systems. Early on September 10, French intelligence issued a general air-raid alert for Faya-Largeau, also adding that a deployment of chemical weapons was possible. The French soldiers were put on full alert, but nothing happened during the morning or early afternoon. It was not until around 1600hr local time that a Tu-22, escorted by a pair of MiG-25s, approached from the direction of the sun and released ten FAB-500M54 bombs.

A single French Stinger was fired in return, and the Chadians fired several SA-7s, to which the bomber responded by dropping flares and firing its tail-mounted cannon. All the MANPADs fired missed their targets — but the Libyan bombs did not. A Chadian ammunition depot near the local airport was hit, causing a giant fireball. Neither alerted nor protected, dozens of Chadian troops and civilians were killed and injured in the ensuing conflagration. About 50 of the wounded were subsequently evacuated to N'Djamena by French and Chadian transport aircraft. This failure to protect Faya-Largeau ultimately led to a major rift between the French and the Chadians; the French troops were declared "undesirable" and forced to leave the city.

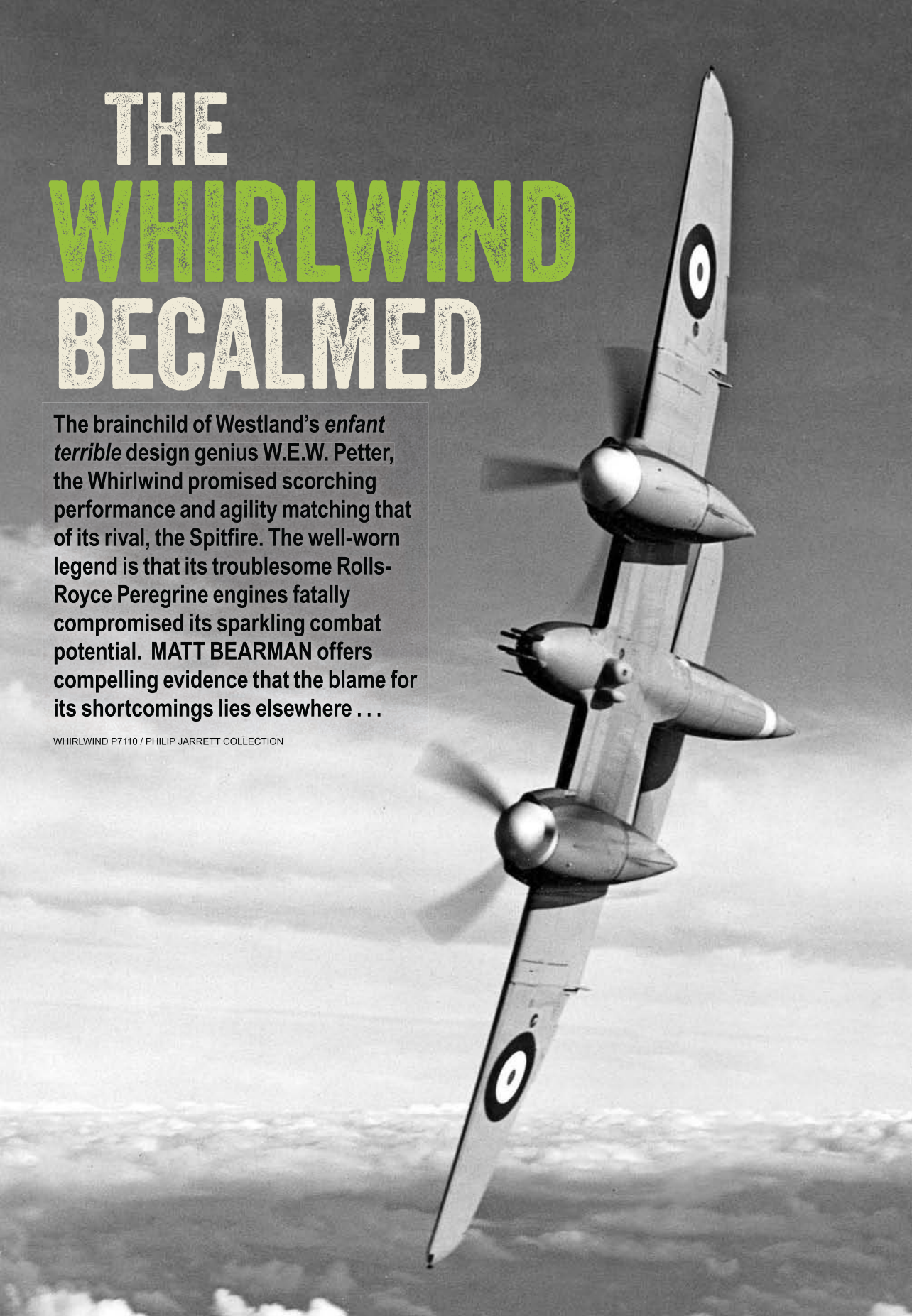
For the French forces, the very strict rules of engagement imposed by the *Commandement des Éléments Français* (COMELEF — French Military Command) did not allow an officer the authority to shoot down an enemy aircraft without permission from Paris. For example, it was not until the Libyan *Blinder* penetrated Chadian airspace on September 7 that defensive action was authorised; with the Chadian capital located on the border with Cameroon, this left little time for the air defences to react. It seems clear that this Tu-22 operation was near-suicidal, and the failure of the first missile was a lucky break for the crew — their luck quickly ran out, however.

At Abéché the failure of the Centaure radar should have allowed the *Blinder* to complete its raid with impunity, but the non-synchronisation of the attack with that of N'Djamena allowed the Crotale shooting officer to anticipate it. Of the four missiles fired, two played their roles by forcing the crew to carry out defensive manœuvres, but did not do enough to equal the feat of the missile crews in the capital.

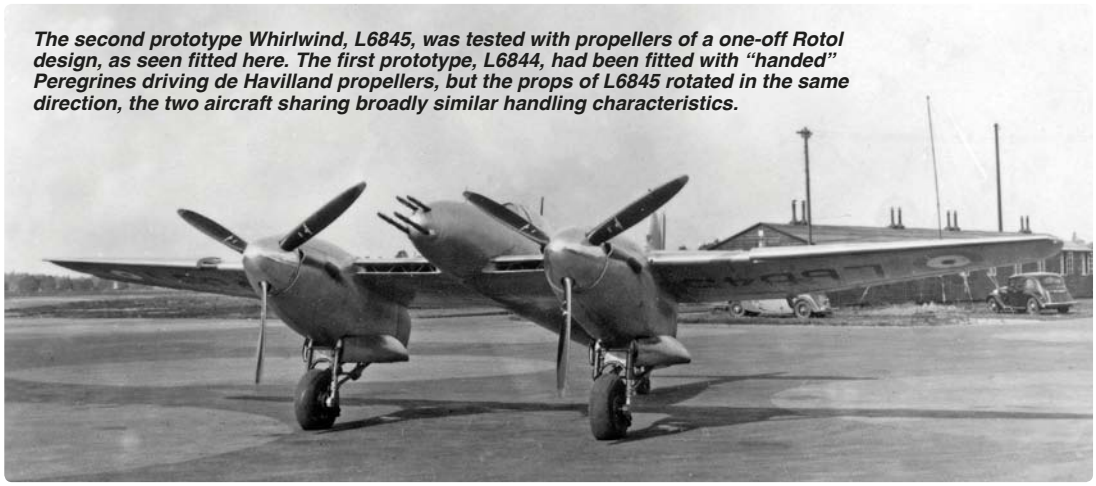
The series of engagements in Chad between Libya's ageing Tu-22s and France's most up-to-date air defences could have ended much more dramatically for either opponent; luck had a major part to play on both sides.

THE WHIRLWIND BECALMED

The brainchild of Westland's *enfant terrible* design genius W.E.W. Petter, the Whirlwind promised scorching performance and agility matching that of its rival, the Spitfire. The well-worn legend is that its troublesome Rolls-Royce Peregrine engines fatally compromised its sparkling combat potential. MATT BEARMAN offers compelling evidence that the blame for its shortcomings lies elsewhere . . .



WHIRLWIND P7110 / PHILIP JARRETT COLLECTION



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The second prototype Whirlwind, L6845, was tested with propellers of a one-off Rotol design, as seen fitted here. The first prototype, L6844, had been fitted with "handed" Peregrines driving de Havilland propellers, but the props of L6845 rotated in the same direction, the two aircraft sharing broadly similar handling characteristics.

UNCONVENTIONALLY pretty, the Westland Whirlwind has always attracted controversy. For some it was a world-beater that was unfairly cancelled in its prime, while others see it as a lame duck that should never have left the drawing board. One thing that both sides agree on is that it was let down by its engines, an apparent rare mistake by Rolls-Royce called the Peregrine. There is compelling evidence, however, to suggest that the blame lay somewhere else entirely.

The first person to cite poor engine performance in writing was perhaps the Whirlwind's own "famously difficult" designer, William Edward Willoughby "Teddy" Petter. In November 1940 he came back to Yeovil from a visit to No 263 Sqn, then working-up on the radical new fighter in Scotland, claiming to have discovered that, unlike the prototype, his creation was suffering from a fall-off in supercharger boost with altitude at "twice the rate anticipated".[1] Conveniently ignoring how unlikely this was in his efforts to absolve his design from blame for its failings, he painted a picture of an aircraft that progressively became slower and more useless at anything above a full-throttle height [2] of 15,800ft (4,820m), thanks entirely to the "third-party" engines.

A POTENTIAL GAME-CHANGER

This seemed a great pity. Down low nothing could catch a Whirlwind. It was manœuvrable, practically viceless and rapidly becoming beloved by its pilots. It certainly should have been a game-changer. As a weapon of war it was formidably potent, with four 20mm cannon packed close together in the nose. Aimed by looking straight down the barrels, these could take out a tank at a time when nothing else flying could.

The Whirlwind was also innovative; it had a bubble canopy, intakes in the leading edges, slats and Fowler flaps. It had a slab-sided fuselage over the wing, which almost nobody noted at the time (or since) was the ultimate solution to high-speed interference drag. *[More on this in a forthcoming feature from the author — Ed.]* So how could Rolls-Royce allow it to be pole-axed so disastrously? The probable answer is that it didn't.

Back in July 1940 the RAF's acceptance testing team at Martlesham Heath had given the aircraft a clean bill of health and a ceiling of 31,000ft (9,450m).[3] However, as the first trickle of Whirlwinds began to arrive with Nos 25 and 263 Sqns in 1940, Service pilots began to ask why the altitude performance wasn't what it should have been, or even what it was when tested. The question escalated to the Chief Technical Officer of Fighter Command, Gp Capt Beardsworth, who evidently telephoned E.J. Jones, Chief Technical Officer at the Aeroplane & Armament Experimental Establishment (A&AEE) at Martlesham Heath, on October 25, 1940, asking him, in the light of the poor altitude performance, what was different between production machines and the prototype tested there, L6845.[1]

Although the telephone call wasn't logged, the written reply is very telling:

"Whirlwind; In reply to your telephone query of today, the following information is available.
(1) Our trials were conducted at an all-up weight of 10,072lb [4,569kg] and this represents the present maximum full load for the aeroplane;
(2) The aeroplane we tested was L6845 and this is the first production aeroplane;
(3) The estimated service ceiling is 30,300ft [9,230m] and the absolute ceiling is 31,000ft."

Elsewhere, Eric Mensforth, the Managing Director of Westland, had stated that L6845 was "identical to a production Whirlwind".[1] Nowhere was it recorded, however, that the "first production aeroplane" (in fact the second prototype) had very different propellers.

Remarkably, the prototype sent by Westland to Martlesham Heath as a representative of the production model was fitted with propellers of a one-off Rotol design, not the de Havilland (D.H.) props hung on all subsequent production

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ABOVE ***The second prototype at Martlesham Heath while undergoing acceptance trials. The Whirlwind was designed to meet Specification F.37/35, Britain's first for a four-cannon fighter. Five of the eight manufacturers invited to tender responded, Boulton Paul and Hawker with single-engined designs and Bristol, Westland and Supermarine with twins.***

RIGHT ***A close-up of the experimental Rotol propeller blades fitted to L6845, but, significantly, not to production machines. Why L6845 was tested with these and not production D.H. props remains unclear. As a result the data acquired during trials was skewed.***

Whirlwinds. Amazingly, nobody (at least at Westland or the A&AEE) seemed to think that this mattered. In the hundreds of pages of records, letters, memos and reports between the RAF, Air Ministry and Westland, including documents which discuss the difference between "handed" and "non-handed" props, and which go into incredible detail about minor changes desired and applied during development, this major change goes completely unmentioned.

AN IMPORTANT DISTINCTION

One thing that stands out about the standard Peregrine "power egg" (a phrase that may have been coined by Mensforth when discussing the Whirlwind) is that its D.H. propeller blades are remarkably thick for a high-performance fighter. According to the few D.H. specifications still available at Farnborough, the thickness-to-chord (t/c) ratio at 0·7 radius is around 0·096.[4] For comparison, the propeller used on the Spitfire I had similar-profile D.H. blades — of type 55409 as opposed to the Whirlwind's 54409 — but with a crucial difference; a t/c ratio of 0·076 at 0·7 radius.

The science of propellers can be rather arcane. Although propellers are a means of translating an engine's power into motion, the factors that make a difference between almost all and almost none of that horsepower actually being applied rapidly descend into very hard sums indeed. Perhaps this is the reason they get overlooked so often.

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Another tricky area is compressibility, first encountered when the ungeared propellers of high-revving engines began pulling themselves through the air at forward speeds that meant the combined velocity of their rotation and forward motion began creeping towards a significant proportion of the speed of sound. That significant proportion is in fact "critical Mach" — the speed at which at least some of the air passing by an object is moving at or above the speed of sound relative to it. An aerofoil accelerates the air passing over it; propeller blades are aerofoils and become the first part of an aeroplane to hit critical Mach. This they started doing regularly in the 1920s, and the first thing that was noticed was the aircraft's reluctance to go any faster. The second was the appalling noise, familiar to anybody who has heard a North American Harvard take off.

This became an area for urgent investigation on

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ABOVE ***Designated by Westland as the P.9, the prototype, L6844, sits outside the hangar at Boscombe Down before its first flight, in the hands of Westland's chief test pilot, Harald Penrose, on October 11, 1938. Note the absence of the "bullet" fairing at the fin/tailplane junction later added to the aircraft, and all subsequent examples, to cure tail buffet.***

LEFT ***The standard de Havilland 54409 propeller blades fitted to production Whirlwinds are seen here on P6984 of No 263 Sqn. The D.H. props were considerably thicker than those used on L6845; a fact which significantly affected the type's performance.***

both sides of the Atlantic. In the USA the National Advisory Committee for Aeronautics (NACA) commissioned research using the very latest in windtunnel technology at its Langley facility in Hampton, Virginia.

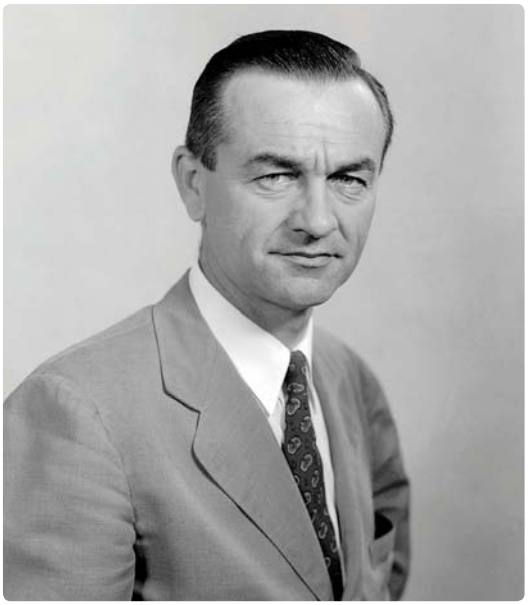
A QUESTION OF THICKNESS

Stepping up to the plate was the brilliant young aerodynamicist John Stack (1906–72), who later solved the compressibility problems built into the Lockheed P-38 (although there is considerable irony in the fact that Petter had already pointed out the inherent problem with the design).

Stack had no access to the kind of rig necessary to spin propellers in windtunnels to see what happened; that would come later. However, in an attempt to study the propeller problem he was able to blow air over a range of different aerofoils at high velocities and record the sudden rise in drag that occurred at specific speeds. By coincidence, one of the aerofoils Stack tested in 1932 was RAF6, the Royal Aircraft Factory's classic, reliable aerofoil from 1912, as used on the Curtiss Jenny. It was commonly used for propellers, and was adopted by D.H. in 1939 for the DP54409 blade specifically designed for the Whirlwind — despite being eminently unsuitable.

From the results of Stack's work, published as *The NACA high-speed windtunnel and tests of six propeller sections* in 1934, it was clear that the RAF6 section was the most vulnerable of the common aerofoils to what had become known as "compressibility drag". Even at the precise angle of attack that produced the minimum possible drag, RAF6, modified to have a t/c ratio of 0·08, suddenly became extremely draggy at anything above Mach 0·7. At 15,000ft in a climb the Whirlwind's propeller blade-tips (at roughly 0·08 t/c ratio) were already through Mach 0·72. The drag on the props started creeping up, largely unnoticed at first.

While similar work had been done in the UK, especially on the mathematical side, there seemed to be some disconnect between theory and practice on this side of the Atlantic. Even as late as 1946 the Aeronautical Research Council (ARC) appeared to be re-inventing the wheel with a report from Farnborough's 24ft (7·3m) windtunnel. The ARC's *Reports & Memoranda (R&M) No 2357* stated as plainly as a Royal



NASA

LEFT ***American aerodynamicist John Stack joined the staff of the Langley Memorial Aeronautical Laboratory as a junior aeronautical engineer in July 1928, and undertook pioneering work on high-speed propellers during the 1930s. Stack later went on to become one of the leading lights of the USA's Bell X-1 project, the world's first aircraft to exceed the speed of sound.***

Aircraft Establishment tech paper could manage that between Mach 0·5 and 0·9, "it will be seen that [the rise in] minimum drag coefficient increases steadily with blade thickness" — and profiles are not even considered in its comparison of blades.

THE CONSTANT-SPEED PROP

Here another potentially difficult concept comes into play; that of the constant-speed propeller. The aim of this development, also from the pre-war blossoming of aeronautical science, was to keep the engine turning at the optimum speed to produce the maximum horsepower. This it was required to do regardless of whether the aircraft was moving slowly, say on take-off, or at its maximum speed. This was done by changing the degree of the propeller's "bite" — the angle of attack of the propeller blades. By increasing the blade's angle of attack, drag is increased, thus creating a braking effect on the engine. To maintain constant r.p.m. at varying speeds, pitch is controlled, maintaining something optimum. If the engine begins slowing owing to increased drag, the blade's pitch is altered to become finer. A constant-speed unit (CSU) automates this process. The desired r.p.m. is set; the CSU senses if the shaft-speed drops, and "fines" the blades appropriately (and vice versa). The Whirlwind had two D.H. CSUs under its sleek cowlings.

When more drag — not profile drag as a direct result of the angle of attack, but from an external drag factor — is applied, the CSU turns the blades anyway. The system is "blind" to the cause, so when buckets of drag are dropped on a blade by compressibility as it hits a certain relative Mach, it "fines" in response.

In their 1938 NACA paper *The effect of compressibility on eight full-size propellers in the take-off and climbing range*, David Biermann and Edwin P. Hartman were able to spin blades in airstreams and record the results. Once again the British RAF6 profile was tested, this time on 10ft (3·05m)-diameter BuAer profile 5868 blades of nine per cent thickness (measured, as was standard at the time, at 0·7 radius). This was so close to the DP54409 blade as to be practically a measure of a Whirlwind propeller in flight, except that it was thinner at 0·7 radius. (The Whirlwind Fighter Project — www.whirlwindfighterproject.org — of which the author is a member, measured a surviving Whirlwind blade to check this.)

The prescient Biermann and Hartman made a point of testing controllable propellers on their rig, and, even more usefully, they tested RAF6 in this context and recorded the deflection of the blades required to attain a new optimum that maintains the desired r.p.m. In fact this only really came up with the RAF-section blades. They even made a note of the loss of thrust it incurred.

In level flight there will be a steady drop-off in performance at higher altitudes, mainly because of the blade adjustment necessary to maintain r.p.m., but also owing to a slight decrease in efficiency. This is enough to make the maximum speed less than it should be (or would be with thinner and better-profiled blades), even as low as full-throttle height (15,800ft) and increasingly so above this.

Interestingly, this effect of propeller profile and thickness on performance at full-throttle height had already been observed and carefully recorded in the UK, in joint tests conducted by The Air Ministry, Rolls-Royce, Rotol and Supermarine, intended to check propeller selection for the Spitfire Mk II.[5] The results of trials with various propellers clearly showed a direct correlation between actual altitude at which maximum speed could be achieved around full-throttle height and thickness of propeller section. That this pointed clearly towards some effect was not commented on at the time, probably because it went against the belief that height of maximum speed was the same as height of maximum horsepower.

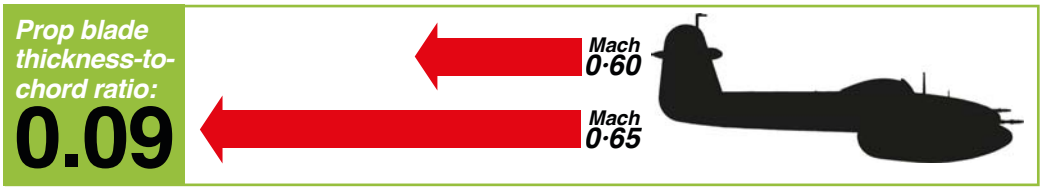
PRACTICAL APPLICATION

In June 1940 Sqn Ldr Henry Eeles was tasked with working up No 263 Sqn on Whirlwinds, and that September he was asked by Air Officer Commanding Fighter Command Hugh Dowding (who may not have been entirely focused on the subject at that time) for his initial comments on the aircraft. After making it clear that the aircraft was quite special up to 15,000ft Eeles wrote:

PROPELLER BLADE THICKNESS

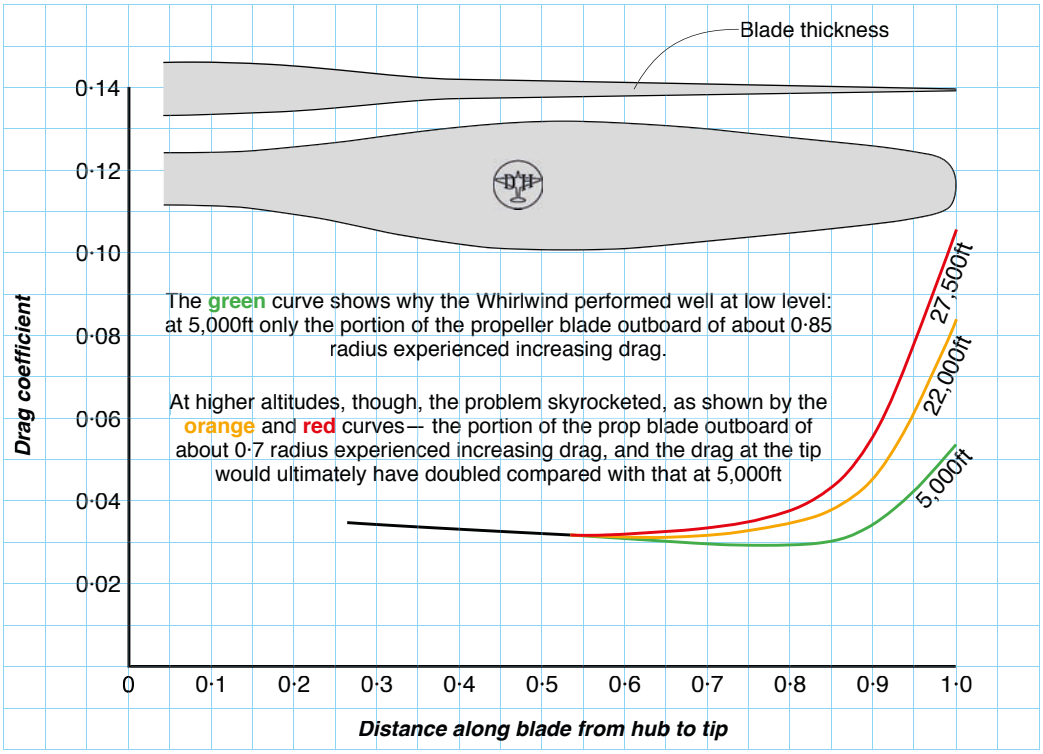
HOW A MINOR DIFFERENCE CAN HAVE A MAJOR EFFECT

The arrows' lengths compare the propellers' compressibility drag at two blade speeds:



— or, to put it another way, if you increase the propeller blade thickness ratio by a mere single point, you increase the propeller drag by a completely disproportionate percentage. The diagram above is for propeller-blade thickness/chord ratios and blade speeds measured at 0·85 radius out from the hub, and at an angle-of-attack of 4°, a normal operating angle for a propeller blade. To visualise the speed of the blade, Mach 0·65 equates to the Whirlwind climbing at an airspeed of 200 m.p.h. at 27,500ft.

And that's not all — as the Whirlwind climbed higher, the speed of sound reduced . . .
. . . which meant more and more of the propeller blade "went critical" in terms of drag, and thus the aircraft "hit a wall" performance-wise. This is shown in the green, orange and red curves on the graph below:



DIAGRAMS BY MICK OAKEY, WITH THANKS TO MATT BEARMAN

VIA AUTHOR

VIA AUTHOR

ABOVE ***The first two production Whirlwinds, P6966 (seen here) and P6967, were originally delivered to No 25 Sqn at North Weald in June 1940 for night-flying trials; but the unit was equipped with Bristol Beaufighters instead, and the two aircraft were reallocated to the first Whirlwind unit, No 263 Sqn, at Grangemouth.***

LEFT ***The Whirlwind's ingeniously devised oil-cooler intakes were incorporated into the wing centre section, as seen here. Cooling air would enter via these "letterbox" intakes in the leading edge and be ducted through the spar to the three-element radiators buried within the centre section.***

"It must be emphasised, nevertheless, that the performance of the Whirlwind above 20,000ft [6,100m] falls off rapidly, and it is considered that above 25,000ft [7,600m] its fighting qualities are very poor. The maximum height so far attained is 27,000ft [8,200m] but on every occasion that a height test has been carried out there has been a minor defect, either in airscrew revolutions or in lack of boost pressure."[1]

Another summary of early experience with the Whirlwind, put together on behalf of No 13 Group (responsible for the air defence of Scotland, Northern Ireland and the north of England) as a report to the Air Ministry, mentions "boost-pressure variations", but suggests this is down to the unreliable Exactor controls in the cockpit. There is no record of any unusual boost curve; nothing tabulated or charted on record. The only climb-curves for a production Whirlwind come from trials of P6997 with a 500lb bomb under each wing; boost "decay" looks entirely normal, and very similar to L6845. Unfortunately the data ends at 27,000ft.

Returning to the theory, it appears that in a climb there is the potential for another, more serious problem to arise from thick, draggy blades; an effect caused by "hunting", compounded by the blades' twist being optimised for higher forward speeds.[6] When an aircraft is climbing, the tips of the propeller blades are always at slightly too coarse a pitch, i.e. they "bite" more than necessary, so they cannot be at their lowest-drag angle of incidence. The greater the incidence, the greater the drag. As the Whirlwind ascended (more slowly than it would with thinner props), the speed of sound dropped. All things being equal, the relative Mach over the blades increased, and more and more of the blade (moving inwards) "went critical" as critical Mach itself lowers.

At the same time the engine was losing horsepower, in the way one would expect of an aircraft climbing above full-throttle height. As compressibility drag came on exponentially, the CSU continually "corrected" the blade angle — hunting for a lower drag regime — possibly until it had gone through the minimum drag angle of the blades. Still not finding a low enough drag coefficient to enable the 2,850 r.p.m. it needed on the reduced horsepower available, it did the only

Harald Penrose at the controls of Whirlwind P7110 in September 1941, by which time the aircraft had begun establishing a reputation as an exceptional weapon for lower-altitude duties, including ground-attack and intercepting low-level enemy intruders. This machine was written off during a forced landing near Warmwell, Dorset, in July 1943.

PHILIP JARRETT COLLECTION

thing it could; kept on reducing the pitch of the props, on into negative angle of attack.[7]

In this possible condition, P-factor (the effect of aircraft pitch) means that some parts of the prop are still pulling, others are being pushed. This would induce shockwaves everywhere, running up and down the blades as they spin, and no real net thrust being generated. Furthermore, wildly varying dynamic pressures would be passed into the ram-air intakes, which sat immediately behind the blades.[8] The system became what a physicist would call "chaotic". The intermittently windmilling prop produced fluctuating boost pressures on top of reduced r.p.m.

To the hapless pilot this looked like an engine problem. Whether or not this aerodynamic breakdown is what Eeles was describing as a "minor defect", there is little doubt that the propeller blades chosen for the Whirlwind were much too thick, and must have had a serious effect on performance.

PROVING IT

In 1940 the de-Havilland-bladed prototype, L6844, was mounted on pylons in the RAE's 24ft windtunnel and thoroughly drag-tested.[7] The unpublished Part III of the document relating to the findings still resides at The National Archives in London, and includes the only known record of the maximum speed of the prototype with the D.H. prop. It was 350 m.p.h. (563km/h).

The report notes that windtunnel drag tests on the same airframe and some thrust calculations indicated that its top speed should have been 355 m.p.h. (570km/h) — similar to the Rotol-equipped L6845. The only way this could be accounted for was a difference between calculated and actual propeller propulsive efficiency.[9] The report stated that this efficiency would need to drop from 77 per cent to 73 per cent to fit the actual top speed.

Although the Farnborough scientists factored in compressibility on the blades, they did make one error; their calculations were based on a blade thickness of nine per cent (doubtless resorting to Biermann and Hartman for their figures, as the blades were so similar). However, the blades were 9·6 per cent thick in reality. This could be the simple explanation for the four per cent difference in propeller efficiency that was noted between calculated and actual. With altitude, the problem could only get more serious.

Above its own critical altitudes the performance drop-off curves of the Spitfire I were similar to that of the Whirlwind prototype. It is interesting to note that up to 10,000ft (3,050m) the Whirlwind (in service) climbed considerably faster than the Spitfire. Apart from the thickness difference, the two aircraft had propeller blades of very similar basic design. According to the RAE, the Spitfire's DP55409 blade was thinned even further by D.H., to get an even higher critical altitude and more speed out of the fighter.[10] Both encountered the phenomenon of performance drop-off above critical altitude. Each of the Whirlwind's Peregrines was faced with turning props against compressibility with less horsepower than a Merlin, but this was not because they were faulty.

By the time later marks of the Spitfire and other types such as the North American Mustang were capable of more than 420 m.p.h. (675km/h) at altitude with two-stage superchargers and blade-tip speeds higher than Mach 1, the blades were of very thin section and NACA-developed profiles which negated compressibility drag, CSU correction and loss of thrust completely.

In hitting these limits, both the Whirlwind and the Spitfire ran into the issue of being faster than almost everything else. The difference was, whereas Rolls-Royce, the RAF and de Havilland got together to work out how to make the Spitfire even better, nobody seemed that interested in helping out Westland with its baby. It seems a pity, with hindsight, that nobody thought to try thin blades on the Whirlwind (or even refit

PHILIP JARRETT COLLECTION

ABOVE ***Only two squadrons — Nos 253 and 137 — flew the Whirlwind operationally, the type's last sortie being performed by the former on November 29, 1943, but not before the aircraft had proved itself a highly capable ground-attacker; bomb-equipped examples, as seen here, were dubbed "Whirlibombers".***

the Rotol design), rather than blame the engines.

Shortly after receiving Eeles's report, Dowding made the decision to keep the Whirlwind away from any fighting in the south, sealing its reputation as the fighter that missed the Battle of Britain. In the same correspondence in which he forwarded Eeles's comments to Lord Beaverbrook, the Minister of Aircraft Production, he went on to say, "the limiting factor in the present fighting against Me 109s [sic] in the south of England is performance, manœuvrability and climb at high altitudes, and a difference in service ceiling of 2,000ft [600m] is a very important advantage. It therefore seems to me quite wrong to introduce at the present time a fighter whose effective ceiling is 25,000ft [7,600m]".

Ultimately, the decision to discontinue production of the Whirlwind after only 114 had been built was an economic one. Rolls-Royce needed to concentrate on developing and producing Merlins and Griffons, and it was "extravagant" (according to Dowding) to produce a fighter that took two engines to do what another might with one. Nevertheless, it should be more than a footnote to say that the Whirlwind went on to serve for another three years, unaltered and very successfully, in the role of a low-level strike aircraft over the Channel and occupied France.

And what of the Peregrine? In a letter addressed to the Air Ministry, dated September 24, 1940, Air Vice-Marshal Richard Saul, Officer Commanding No 13 Group RAF, made it plain: "The Rolls-Royce Peregrine [used only for the Whirlwind] has given very little trouble".

1 The National Archives (TNA), London, various correspondence
2 "Full-throttle height" is the altitude above which a set engine-inlet manifold air pressure (MAP — atmospheric pressure plus any boost) selected by the pilot is no longer available at full throttle. The aircraft can still climb above that altitude; but, as ambient air density reduces with height, it will be impossible to obtain the rated boost (the "red-line" maximum MAP permitted for the engine). It is also known as "critical altitude"
3 TNA various files
4 Cleaver, A.G., de Havilland *Report R 105: Miscellaneous Propeller Aerodynamic Calculations*, 1942
5 Morgan, Eric B. & Shacklady, Edward, *Spitfire: The History* (Key Publishing, 2000)
6 Annand, W.J.D., general performance-reduction equations for reciprocating-engined aircraft with constant-speed propellers, *Aeronautical Quarterly* 1950, Vol II
7 Biermann, David & Hartman, Edwin P., NACA TR 641: *The negative thrust and torque of several full-size propellers and their application to various flight problems*, 1938
8 Chapman, D.R., NACA A5C10: *Investigation of slipstream effects on a wing-inlet oil-cooler ducting system of a twin-engine airplane in the Ames 40ft x 80ft windtunnel*, 1944
9 Bottle, D.W. & Somerville, T.V., RAE BA Departmental Note 38 (unpublished): *Tests on Whirlwind L6844 Part III; estimation of top speed and drag from 24ft tunnel and performance tests*, 1940
10 Haines, A.B., ARC Reports & Memoranda No 2357: *24ft tunnel tests on a Rotol wooden Spitfire propeller* (Aeronautical Research Council, 1946)

A veritable haven for propliners, Heathrow was a bustling hub of activity for the "big fours" of numerous airlines in the late 1940s, including the SNCASE SE.161 Languedocs of Air France (right) and the Lockheed Constellations of Air-India International.

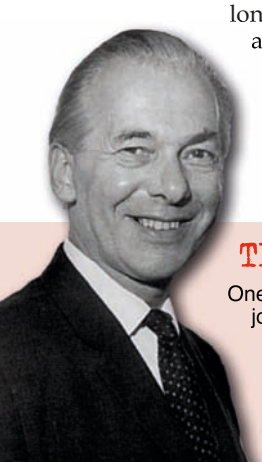
HEATHROW

THE ROARING FORTIES

During the late 1940s John Stroud was a regular visitor to London's new airport at Heathrow, where he made the most of unrestricted access to train his camera on the gathered exotica flying in from, and off to, destinations across the globe. **NICK STROUD** (no relation!) accompanies some of John's photos with a look at the airport's early years

IN 2017 THE busiest airport in Europe by passenger traffic, and the third-busiest in the world by international traffic, London's Heathrow Airport has long since secured its position as one of the world's most important air-travel hubs. With nearly 475,000 movements in 2016, carrying more than 75 million passengers and 1·5 million tonnes of cargo, Heathrow has come a long way since its official naming as The London Airport by Lord Winster in March 1946. Then it was still little more than a single-runway airfield with no hangars or workshops, lined with tents and huts erected as makeshift terminals set between the runway and the Bath Road to the north. Within just a few years, however, Heathrow had become a regular perch for airliners from far and wide, visiting exotica coming from as far afield as North America, Africa and the Far East. It was also the starting point for the transatlantic and Empire routes of BOAC and British South American Airways (BSAA), the latter's Yorks, Tudors and Lancastrians beginning their long voyages to South America from the new airport.

It was to this thriving hub of propliner activity that John Stroud paid several visits during 1948–49, some of the fruits of which we present here — much of it for the very first time.



The John Stroud Archive

One of Britain's most respected aviation journalists and authors, John Stroud (born April 3, 1919) joined Imperial Airways aged 14. Six years later he became a freelance aviation writer and in 1963 was appointed General Editor of the Putnam series of aeronautical books. Also a talented photographer, John continued to publish material until his death in March 2007. In 2014 a substantial part of John's archive — including numerous rolls of previously unseen 35mm film — was acquired by A Flying History Ltd, and forms the basis of this regular series.

THE EARLY DAYS

Located roughly 14 miles (23km) west of the centre of London, Heathrow has been well-acquainted with aircraft since the earliest days of British aviation. Nearby Hounslow Heath can trace its use as an aerodrome back to 1910, and was later used by the Royal Flying Corps during the First World War for nightfighter training and air defence. After the war the Air Ministry acquired the airfield at Hounslow and named it the London Terminal Aerodrome, from which the world's first daily scheduled international commercial air service took off when an Airco D.H.16 of Air Transport & Travel Ltd flew from Hounslow to Paris on August 25, 1919. By the spring of 1920, however, Hounslow Heath had been re-acquired by the War Office, and it would not be used as an aerodrome again.

Other inter-war airfields west of London included Hanworth (Feltham) and Heston (opened in 1929), the latter becoming a major aerodrome for London, second only to the capital's official airport at Croydon, which had opened in March 1920. When British Airways Ltd moved to Heston in May 1938, the latter was considered the equal of Croydon, but its use as a commercial airfield was to be short-lived. With the outbreak of war in 1939 Heston was requisitioned by the RAF and became a very active military base throughout the war. Along with Hanworth, Heston was considered as a prospective site for the development of a major international airport for London after the war; but it was felt that Heathrow offered better potential for future growth, with more surrounding land into which to grow.

ABOVE ***Heathrow was officially named "The London Airport" in March 1946 — and, as may be seen here, clearly included the definite article. Reportedly, the airport was so named because it was thought that the name "Heathrow" might present difficulties for pilots and crew who used English as a second language.***

In 1928 aircraft manufacturer Fairey Aviation was given notice to vacate its leased premises at Northolt, where the company, based at nearby Hayes, had been testing its aircraft since the First World War. After an extensive search, the company paid £15,000 in January 1929 to the vicar of Harmondsworth for 71 acres of land, with another 78 acres added shortly thereafter. A landing area of "Hunterised" turf was laid

BELOW ***Thick smoke billows over the leading edge of Air-India International Lockheed L-749 VT-CQR's port wing as its No 1 Wright R-3350 twin-row 18-cylinder supercharged radial piston engine is run up before departure from Heathrow in 1949. Named*** **Rajput Princess,** ***this Connie was delivered to Air-India International in February 1948.***

ABOVE ***Delivered to the RAF in March 1946, Avro Lancastrian C.2 VM738 served with No 231 Sqn before being sold to BSAA on February 18, 1948. Bearing civil registration G-AKTB and named*** **Star Glory**, ***it is seen here at LAP on August 31, 1948, in an unsual colour scheme. It went to Flight Refuelling Ltd in 1949 and was scrapped in 1951.***

out and a concrete apron area completed by the spring of 1930.

Variously known as the Great West Aerodrome, Harmondsworth and Heathrow, the airfield was officially opened on June 28, 1930, and the first entirely new Fairey aircraft to be test-flown from it was the prototype Hendon bomber, which made its first flight there on November 25 that year. Over the next decade more than 1,500 Hayes-built Fairey aircraft were test-flown from the Great West Aerodrome, which also became a regular venue for the Royal Aeronautical Society's 1930s garden parties.

In 1942 the Great West Aerodrome was surveyed and deemed suitable as a potential bomber base, with enough room to incorporate the RAF's standard triangular pattern of runways — although the reasoning offered the following year, that the base could be used for the deployment of USAAF Boeing B-29 Superfortresses, did not quite ring true, especially given that the type was never deployed operationally to the UK. It later transpired that an eye was in fact being kept open for a suitable site for the development of a major airport after the war, based on the recommendations of architect and town planner Professor Patrick Abercrombie.

Headed by Harold Balfour, then Under-Secretary of State for Air, the airport project and its real intent were kept secret, Balfour later admitting in his memoir *Wings Over Westminster* (Hutchinson, 1973) that he deliberately deceived the government committee into believing that the airfield needed to be requisitioned and developed as a base for long-range transport aircraft supporting operations against Japan in the Far East. In reality the site was only ever under consideration as a post-war airport, Balfour invoking an emergency wartime requisition order so as to avoid a long and costly public inquiry; the development of the site would require the appropriation of some 1,300 acres of fertile land then being worked by numerous farmers and market-gardeners.

Understandably, the owner of Fairey Aviation, Sir Richard Fairey, was far from happy too. The wartime legislation provided no obligation to pay compensation, although the company was offered the pre-war farming land market rate of £10 per acre, which was roundly rejected, the manufacturer having spent a great deal of its own time, effort and money developing the site into one of the largest privately-owned grass airfields in the country. Sir Richard wrote to his co-chairman at the time:

"It is manifestly so much easier for the civil aviation authorities to look over the airports near London, that the foresight of private companies has made available, and then use government backing forcibly to acquire them, than to go to the infinite trouble that we had in making an aerial survey to find the site, buying the land from different owners, and building up a fine airfield from what was market-gardening land.

"And why the haste to proceed? I cannot escape the thought the hurry is not uninspired by the fact that a post-war government might not be armed with the power, or even be willing, to take [the] action that is now being rushed through at the expense of the war effort."

The airfield was nevertheless requisitioned by the Air Ministry in April 1944, although the Ministry of Aircraft Production stipulated that,

ABOVE ***Proudly flying the Icelandic flag, Douglas C-54 TF-RVH (c/n 7485) of Loftleidir is refuelled at LAP in August 1948. Named* Hekla *in honour of one of Iceland's most active volcanoes, the aircraft joined the Icelandic airline in June 1947. Leased to Seaboard & Western Airlines in 1951, it was destroyed by fire at Pisa in January 1952.***

owing to its invaluable war work, Fairey would have to be provided with an alternative site for its testing programme. The latter was transferred to Heston, where the company stayed until 1947 when it relocated to White Waltham in Berkshire.

CONSTRUCTION BEGINS

In May 1944 eviction notices were served and the construction of Heathrow began, one long runway having been completed by the end of 1945, by which time the spurious plans for its military use had been permanently sidelined and its prospective development as a major international airport announced. No military aircraft had ever been based there, but a number of RAF Avro Lancasters and Handley Page Halifaxes had diverted to Heathrow during the last days of the war. According to Peter J. Marson's excellent feature for Air-Britain's *Aviation World* (*London Airport — The First Decade: 1946 to 1955*, Summer 2015 issue), the first post-war landing was made by a "Moth-type biplane" on May 27, 1945. The last Fairey flight from Heathrow was the departure of a Firefly, with Peter Twiss at the controls, on October 24 that year.

Ownership of the new airport was handed over from the Air Ministry to the Ministry of Civil Aviation on January 1, 1946, when BSAA's General Manager, Air Vice-Marshal Don Bennett, the guiding force behind the RAF's wartime Path Finder Force, departed in Lancastrian G-AGWG, named *Star Light*, on the first of six route-proving flights to Buenos Aires, Argentina. The first regular scheduled departure from Heathrow was BSAA Lancastrian G-AGWK *Star Trail*, bound for Buenos Aires, on March 15, 1946.

The last RAF personnel were withdrawn at the end of January 1946, by which time the British Cabinet had agreed to the next stage of Heathrow's development, which the April 25, 1946, issue of British weekly magazine *Flight* described in detail:

"As regards further development, the total

BELOW ***Panair do Brasil was the first airline outside the USA to operate the Constellation, and received its first examples in March 1946. Originally serving with Pan American as N88865, L-049 c/n 2066 was sold to Panair in October in 1947 to become PP-PDA. Sadly, it crashed near São Paulo, killing all 17 aboard, on June 17, 1953.***

ABOVE ***A splendid shot of BOAC L-749A G-ALAM (c/n 2554), named*** **Belfast,** ***beside the BOAC hangars during one of John Stroud's 1948 visits to LAP. Originally EI-ADA*** **St Bridget** ***with Aerlínte Éireann (Aer Lingus's subsidiary for transatlantic services), the aircraft joined BOAC in June 1948. It crashed at Kallang, Singapore, in March 1954.***

ABOVE ***Bearing Norman Rissen's distinctive "speedman" logo for BSAA on the nose, Avro York G-AHFE awaits another flight to South America. Named*** **Star Vista** ***in BSAA service, the aircraft joined the airline in 1946, but was transferred to BOAC in the summer of 1949. After a move to Skyways in 1955, it was scrapped at Stansted in 1960.***

BELOW ***Sabena DC-4 OO-CBP (c/n 43009) trundles along the taxiway at LAP in 1948 with its outer Pratt & Whitney Twin Wasp engines shut down. The aircraft came to an unusual end when it was destroyed by a bomb dropped by a Katangese Air Force Fouga Magister at Elizabethville, Congo, in September 1961, during political unrest there.***

ABOVE ***Lancastrian 1 G-AGMJ, named*** **Naseby** ***in BOAC service, was one of 20 taken from the tail end of Lancaster production and converted for civil use for the airline. The type was far from economical, being fitted with only nine seats, but earned a high degree of prestige by offering a three-day service from London to Sydney.***

area of land which, subject to parliamentary approval, will be acquired is something over 4,000 acres. It extends both north and south of the Bath Road. The ultimate airfield layout will consist of three sets of parallel runways — nine in all — with the terminal area in a central position. The runways will vary in length between 9,200ft [2,800m] and 5,300ft [1,610m], but one can be extended if necessary to 15,000ft [4,570m] and another to 12,000ft [3,650m]. Three runways will be capable of use at a time, and the maximum capacity of the airport when entirely completed will be 160 aircraft movements an hour in good weather and 120 aircraft movements in bad weather."

On March 25, 1946, Heathrow was officially named The London Airport (including the definite article but referred to frequently thereafter as LAP) by the Minister of Aviation, Lord Winster, in a ceremony held at the airfield attended by a number of aircraft types that would henceforth be using it, including a Lancastrian, York, Tudor, Bristol 170, Vickers Viking and Douglas Dakota among others.

The passenger terminal was essentially just an area of ex-Army tents and duckboarding along the south side of the Bath Road, and the control tower was a standard "very heavy transport type" RAF three-storey example with an additional Seco control hut on the roof. On April 10, 1946, Winster provided a full report in the House of Lords on progress at Heathrow, in which he stated that he expected "Commonwealth and transatlantic services [to be] able to use Heathrow this summer, as soon as the first three runways [are] completed."

The first foreign airliner to cast its shadow on the new airport was Panair do Brasil's brand new Lockheed L-049 Constellation PP-PCF (c/n 2049), which was used for a Rio de Janeiro—London proving flight on April 16, 1946. The first BOAC aircraft to depart Heathrow was Lancastrian G-AGLS, named *Nelson*, which took off for Australia on May 28.

Three days later LAP was officially opened by Lord Winster, an occasion marked by the first arrivals of Pan American and American Overseas Airlines Constellations from New York, both airlines switching their transatlantic terminals from Hurn, near Bournemouth, to Heathrow over the following weeks and months.

Flight still managed to find cause to grumble, however, stating that "there is little cause for congratulation in the fact that transatlantic services are operating into Heathrow, when the only accommodation which can be offered to the passengers before or after a transatlantic crossing is tents". There was clearly still much work to do before LAP could consider itself a world-class international airport.

INTO THE FUTURE

Although LAP was now officially open for business, construction work — referred to by the Labour government of the time as a shining example of "co-operative socialist endeavour" — continued around the 63,000 passengers that had passed through the new airport by the end of 1946. By the middle of the following year the first triangle of runways had been completed

ABOVE ***Delivered to the USAAF in December 1943 as 42-100826, C-47A c/n 19289 participated in Operation*** **Market Garden** ***with the 92nd Troop Carrier Squadron in September 1944. After the war it became one of a batch of surplus C-47As supplied to Polish national airline*** **Polskie Linie Lotnicze** ***(LOT), with which it served as SP-LCE.***

ABOVE ***It was not all scheduled arrivals and departures at LAP in the late 1940s; among the numerous piston-liners could be found the occasional item of real exotica, including the Rolls-Royce Nene-engined Vickers Viking, VX856, the world's first pure-jet-powered transport aircraft, which John Stroud snapped at LAP on August 31, 1948.***

An imposing view of Trans-Australia Airlines Convair 240 VH-TAQ, which became the first of the type to visit Europe when it arrived at LAP on August 28, 1948, on its delivery flight from San Diego to its new owners in Australia.

ABOVE ***Named* John Forrest *in honour of the Australian explorer, Convair 240 VH-TAQ (c/n 64) was the first of five to be delivered to Trans-Australia Airlines. Fitted with extra fuel tanks, it was flown by TAA's chief pilot, John Chapman, on a route through Europe and the Middle East to Melbourne, where it arrived on September 7, 1948.***

and work on the other three to form Heathrow's distinctive "Star of David" double-triangle had begun. The main east-west No 1 runway (10L/28R) was 9,300ft (2,835m) long and ran along the north side, essentially parallel to and south of the Bath Road; No 2 (05R/23L) and No 6 (15R/33L) runways were both 6,000ft (1,830m) long and all three were 300ft (90m) wide.

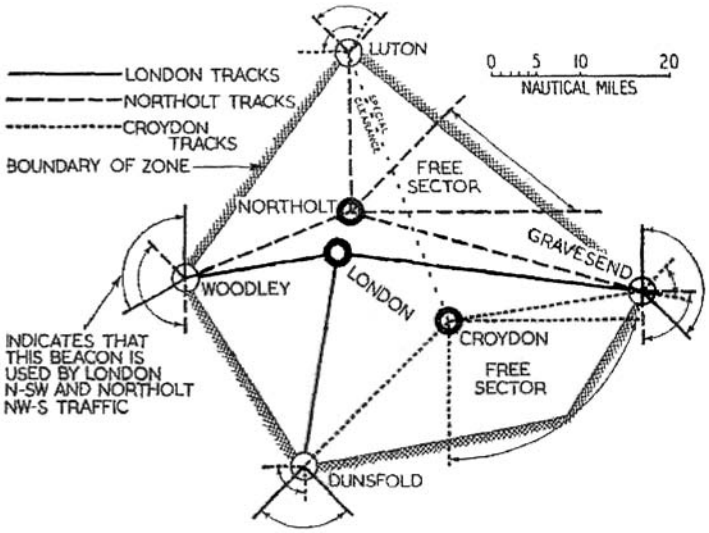
May 1947 saw some 20,000 passengers passing through Heathrow — an average of about 650 a day — with BOAC and BSAA flying 205 aircraft in and 179 aircraft out of the new airport; healthy numbers which looked set to rise. The impact of the sheer scale of work undertaken to create a modern air hub had taken quite a toll on the surroundings, however, as related in a Crown Film Unit documentary on the new airport:

"The local inhabitants see things from a different angle; for the older ones it must have seemed strange indeed to see giant aircraft roaring down paths that once they knew as pleasant loitering lanes. Stranger still to see the streams they had known since childhood turned aside from their old winding courses to new straight concrete beds; and surely the unkindest cut of all — a few of their pubs may have to go."

On June 1, 1947, the public enclosure was opened for the first time. Situated close to the control tower and beside one of the main taxying tracks, the enclosure offered an unsurpassed view of the gleaming airliners arriving from and departing to romantic-sounding foreign climes. The enclosure was open from June to October, at the end of which 246,000 visitors had paid a visit, earning the new airport a handsome £4,300 in parking fees for the 22,800 cars in which they had travelled.

Traffic figures for Heathrow continued to climb consistently throughout 1947, those for October revealing that more passengers had passed through Heathrow than Northolt, which was essentially London's short-haul terminal

Another unusual type photographed at LAP by John Stroud was de Havilland Hornet F.3 PX396 in May 1948. The sleek but pugnacious-looking fighter may have been on its way to Linton-on-Ouse to join No 64 Sqn, with which it served with the codes SH-O. Note also two other de Havilland types in the background; nearest is a Mosquito, behind which is a Dove.



LEFT ***A 1947 illustration showing the four marshalling beacons by which aircraft approaching and departing London's Metropolitan Control Zone were controlled. The track joining Luton in the north and Croydon in the south, across what was increasingly becoming a very busy air traffic region, could only be flown with prior special clearance.***

BELOW ***The vast majority of Air France's post-war European routes were served by its fleet of SNCASE SE.161 Languedocs, which entered service with the airline in 1945. The Gnome-Rhône 14N engines initially fitted to the type proved troublesome, and in 1946 were replaced by Pratt & Whitney R-1830 Twin Wasps. This example, F-BCUB (c/n 28), joined the Air France fleet in November 1947.***

handling domestic and European services, and home to British European Airways (BEA) until its move to Heathrow in the spring of 1952.

By the end of 1947 Heathrow was handling similar numbers of passengers to Northolt on regular scheduled services, although Northolt continued to operate the lion's share of London's traffic, and was generally perceived as London's main airport. (Croydon's post-war use for predominantly domestic routes had dwindled after the August 1946 formation of BEA, which concentrated its operations at Northolt.)

Heathrow's ground-controlled approach (GCA) capability was also improving, with 228 GCA landings (of a total of 1,052 landings) being made in December 1947, 135 of these with visibility of less than two miles (3·2km) and a cloudbase below 1,000ft (300m).

GATEWAYS TO THE WORLD

By the spring of 1948 many of the world's biggest airlines were operating services into and out of LAP, including Britain's own BOAC and BSAA, Pan American and American Overseas Airlines from the USA, Ireland's Aer Lingus, Sabena from Belgium, Trans-Canada Air Lines (TCAL) and Poland's LOT, as well as numerous non-scheduled activities by smaller operators. Heathrow also served as a hub for aircraft passing through on delivery ferry flights to their new owners, both civil and military, some of which were photographed by John Stroud during his visits to the airport during 1948–49.

With London's three major airports — LAP, Northolt and Croydon — being located relatively close together, the need arose for a comprehensive air traffic control system to marshal aircraft into and out of their respective destination airports within the capital. Thus at the beginning of 1948 the Metropolitan Control Zone (generally referred to as the "London Zone") was introduced, a Control Zone being defined as airspace extending from ground level to a fixed height, in this case 10,000ft (3,000m) above ground level.

The London Zone was bounded by four main marshalling beacons which served as entry and exit points to the capital's airports,

In April 1949 Pan American World Airways Boeing 377 Stratocruiser N1028V, named **Clipper Flying Cloud**, *made the type's UK debut at LAP, to great fanfare. John Stroud was invited aboard a flight down to the French coast, during which he got some "hands-on" experience of the Strat at 20,000ft, as seen in the inset photograph* **BELOW.**

used in conjunction with a standard procedure understood and practised by all operators. To the east was Gravesend; to the south Dunsfold, with Woodley to the north-west and another to the north at Luton.

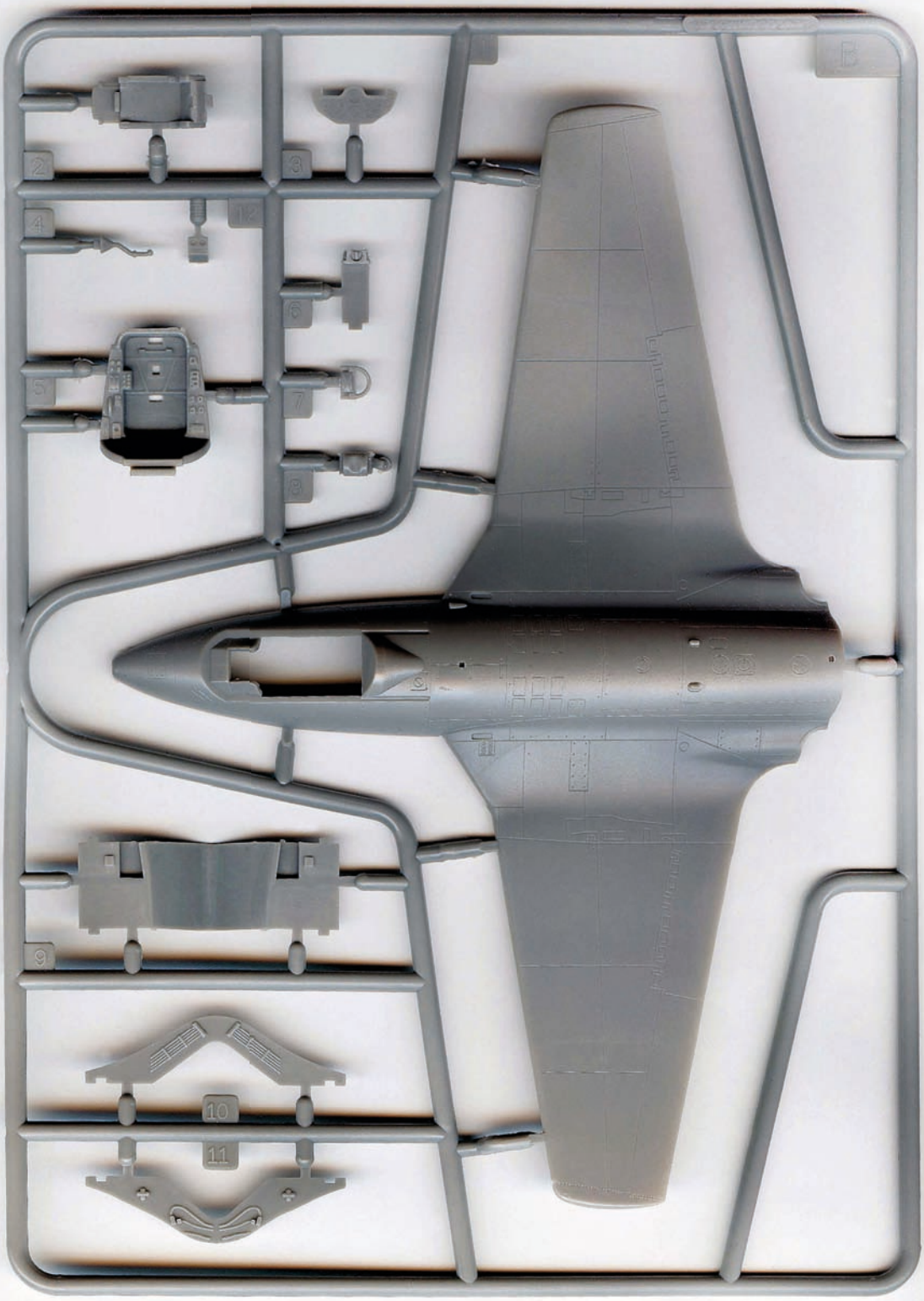
The aircraft would disperse to their various, usually international, destinations through these "gates". Sabena and KLM aircraft heading out for Brussels and Amsterdam would use the Gravesend gate, for example, as would Pan American Connies on their onward flights to Germany. Air France's SNCASE SE.161 Languedocs would make use of the Dunsfold gate on their routes to France, as would the Yorks and Douglas DC-4s of Argentinian airline *Flota Aérea Mercante Argentina* (FAMA) headed for Paris, their first stop en route to South America. Yorks of BOAC bound ultimately for South Africa and the Middle East would use the Dunsfold gate to head out for Bordeaux in the south of France or Castel Benito in Libya, both of which were stops along those routes.

Other operators using the Dunsfold beacon included BSAA, whose Tudors, Lancastrians and Yorks routed through Lisbon; Pan American's Constellations and Boeing Stratocruisers on their way to Istanbul in Turkey; South African Airways DC-4s en route to Johannesburg and Panair do Brasil's Connies heading off to Brazil via Paris. Four-engined airliners of Swissair, Qantas, Air-India and others also joined the throng climbing out over the Staines Reservoir and across the Surrey Hills to fan out from Dunsfold. Atlantic traffic, largely made up of the Constellations of the American operators and DC-4 North Stars of TCAL passed overhead Windsor before leaving the London Zone at Woodley, near Reading in Berkshire.

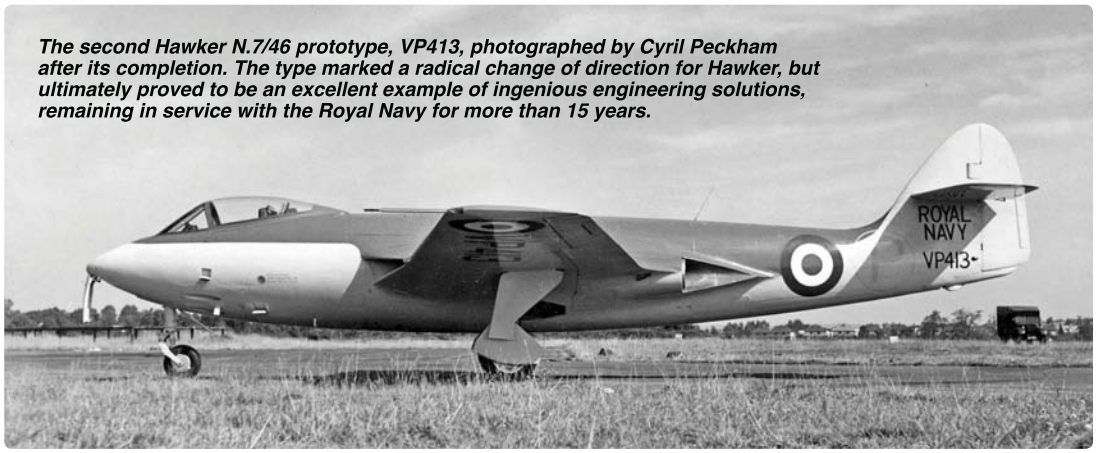
The system accelerated the flow of traffic into each airport, while keeping aircraft height-separated (each airport being allocated a specific height over each beacon, negating the need for co-ordination between the airports). The aircraft descended from their points of entry into the London Zone, thus eliminating time wasted losing height overhead the airport, although if an aircraft needed to be held it would be kept in a holding pattern over or near the airport.

So it was to a relatively new but bustling LAP that John Stroud first brought his trusty camera in May 1948, intent on capturing London's state-of-the-art airport at work, positioning himself down among the "big fours" arriving and departing to glamorous far-off locations, and finding some more unusual fare in the airport's nooks and crannies. It was all rather different from the sprawling mini-metropolis of today which employs some 76,000 people within its boundaries — a population equal to that of nearby town Guildford.

Back in 1948 the intrepid enthusiast might be able to scare up a curled-corner sandwich and a "cuppa" to enjoy in a deckchair beside the control tower while the majestic sailing-ships of the skies rumbled past before roaring off to all points of the globe; today, more than 26,000 cups of tea (and 1,000 bottles of champagne) are sold at Heathrow every day. Unfortunately, the whiff of adventure and the romance of "getting there by air" have also long since departed.



HOW TO BUILD A SEA HAWK



The second Hawker N.7/46 prototype, VP413, photographed by Cyril Peckham after its completion. The type marked a radical change of direction for Hawker, but ultimately proved to be an excellent example of ingenious engineering solutions, remaining in service with the Royal Navy for more than 15 years.

COLIN DODDS COLLECTION VIA AUTHOR

Using a sequence of official Hawker photographs from a contemporary technical brochure, naval aviation specialist **MATTHEW WILLIS** takes us through the construction of one of the prototypes of the company's first jet fighter, the P.1040 — which, while dismissed by the RAF, would go on to provide sterling service for the Royal Navy as the Sea Hawk

THE SERIES OF photographs presented here shows in detail the construction of a prototype Hawker P.1040, which would become the Sea Hawk naval fighter. These official Hawker images follow the assembly of one of the three prototype aircraft ordered by the Admiralty to Specification N.7/46 — VP401, VP413 and VP422 (probably the second) — in Hawker's experimental workshop during 1947–48, from individual components through to a substantially completed airframe. The photographs are particularly fascinating in showing how Hawker elegantly approached the packaging of a jet engine, this being the first of the company's jet aircraft designs to reach the hardware stage.

Although the N.7/46's technology represented a marked step forward from the company's preceding piston-engined fighters, it is notable that the swept-wing North American XP-86 prototype had already flown in the USA by the time the P.1040 made its maiden flight, rendering it effectively obsolescent — perhaps not surprising considering the three-year period that elapsed between the P.1040's conception and its first flight. Nevertheless, straight wings would be used on the majority of first-generation naval jet fighters, and indeed the Sea Hawk remained in front-line service into the 1960s in the Fleet Air Arm, and the 1980s in the Indian Navy, partly thanks to Hawker's careful design.

INGENIOUS DESIGN

In 1944, when Hawker first began working on its first jet fighter, designated P.1035, the design was closely based on the piston-engined F.2/43 design (what would become the Sea Fury). The new design used the same semi-elliptical wing as its propeller-driven stablemate and a straight-through jetpipe for the new Rolls-Royce B.41 (later Nene) centrifugal-flow turbojet engine, much as Supermarine was doing with its "Jet Spiteful" E.10/44 design. However, the long jetpipe threatened to rob a significant amount of power from the engine. Hawker worked with the engine manufacturers to mitigate this by developing a bifurcated exhaust exiting just aft of the wing trailing edge. Hawker's design team was able to fair this into the relatively wide fuselage by creating a thick wing centre-section into which the air intakes were incorporated, which blended into the thin wing. This also had the benefit of reducing interference drag and creating space for the main undercarriage bays. The improved design was known as the P.1040.

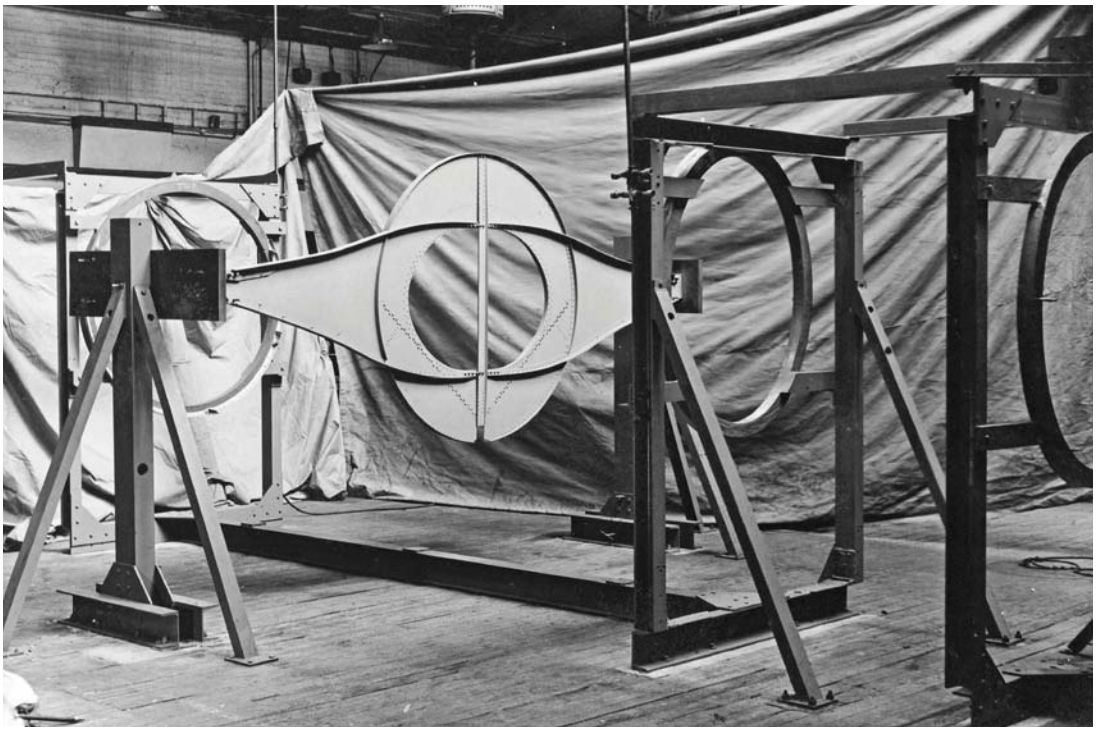
As the design developed, the Sea Fury wings were replaced with straight-tapered mainplanes with a thinner (9·5 per cent thickness/chord ratio) "high-speed" aerofoil section, using updated construction techniques, and which were simpler to manufacture. By this time, all resemblance to the Sea Fury had vanished.

Although the RAF showed little interest in the design, the Admiralty was more enthusiastic, and raised Specification N.7/46 for a naval version of the fighter, issued to Hawker in October 1946. The first aircraft, VP401, was a purely aerodynamic prototype with no armament or naval features. It first flew on September 2, 1947. Two more prototypes were ordered to provide a blueprint for the production aircraft, these being VP413 and VP422. The second prototype flew a year and a day after the first, and the third flew just over a year after that.

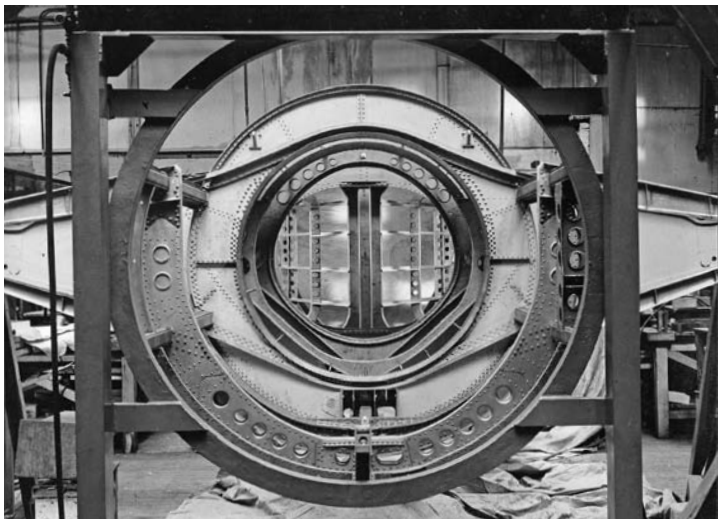
ALL PHOTOGRAPHS VIA AUTHOR UNLESS OTHERWISE STATED

ABOVE LEFT ***The first image from the Hawker material shows a pressed light-alloy fuselage frame from the area of the wing-root intakes, illustrating the recesses where ducting will guide air to the Rolls-Royce Nene engine. The frame has been photographed upside-down; when installed in the airframe, the flat inside edge should be at the base. Notches in the outer edges of the frame are to accommodate the fuselage's longerons and stringers.***

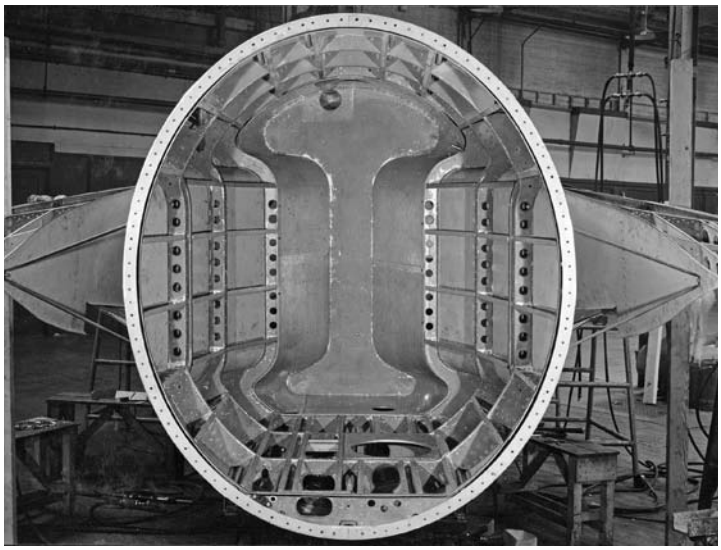
ABOVE RIGHT ***In terms of construction this light-alloy fuselage frame is conventional, although its shape is unusual. The "V" shape in the lower part of the frame was adopted to create space within the fuselage for the main undercarriage bay. The N.7/46's thin wing left less space for the undercarriage than in previous piston-engined designs, while the large-diameter engine and the thicker wing roots required for the intakes left space free just aft of the engine, which Hawker used to house the mainwheels when retracted. The space in the upper half was for a saddle-type fuel tank sitting over the aft end of the engine. The wings were too thin to incorporate fuel tanks.***



ABOVE ***With the engine in the centre of the fuselage, the mainspar could not pass directly through, so a ring-frame had "outriggers" attached, taking the loads from the outer wing spars, in this case the rear spar that carried the flaps and ailerons. The central pillar bisecting the ring-frame passed between the two branches of the bifurcated jetpipe that Hawker and Rolls-Royce developed for the N.7/46. The diagonal flanges on the ring-frame indicate the inner surface of the undercarriage bay, of which this frame formed the aft face. The frame seen (from the rear) in this photograph has been placed in the main fuselage construction jig. The fuselage was constructed in three main sections — the central part, as seen here, the nose section and the rear fuselage and tail section.***

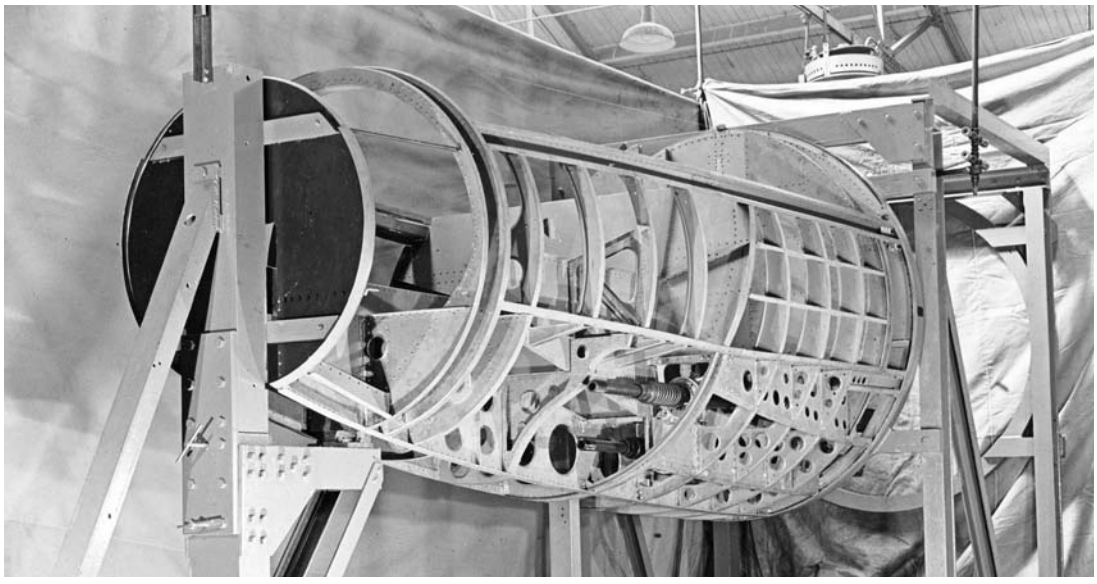


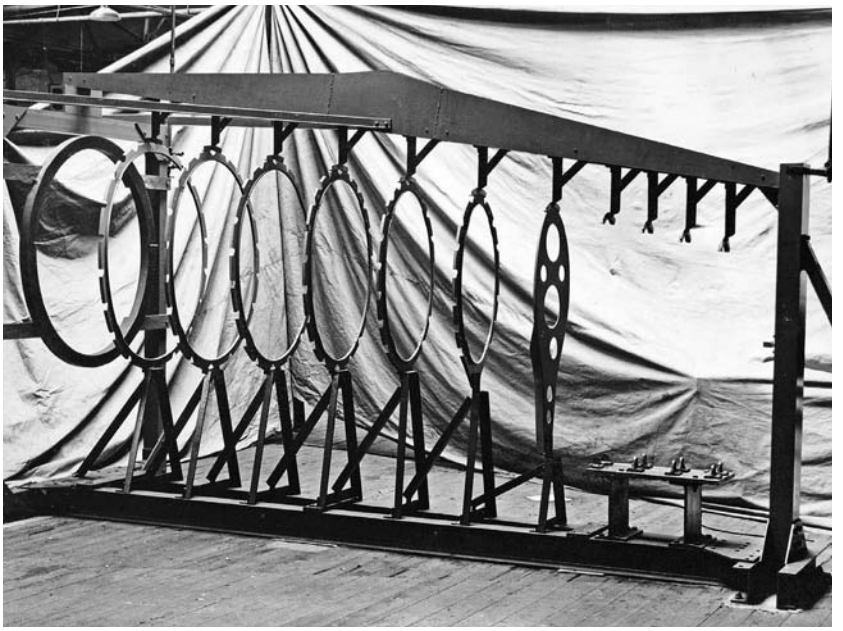
LEFT ***The central fuselage further along in its construction in the jig, looking forward. More frames have been added, forming the backbone of the aircraft. This section would eventually contain the engine and its associated intake trunking, the frames with their recesses for which, as in the first photograph, may be seen at the forward end of the assembly. This sub-assembly would also contain the engine exhaust system, the main undercarriage bays and form the wing/fuselage connection. It demonstrated the biggest difference from piston-engine practice in this transitional jet design.***



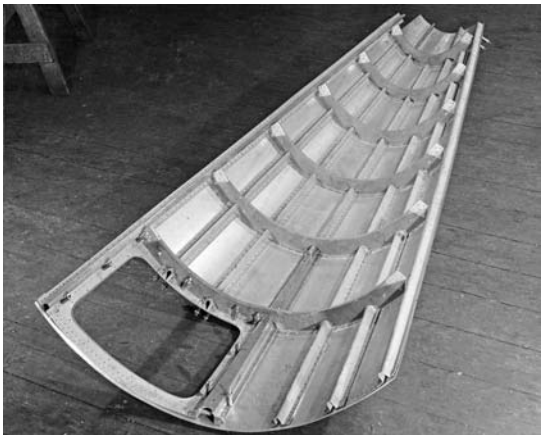
BELOW LEFT ***The same assembly seen from the forward end, now with the skin attached, and the wing root added. This image shows how the intake air was guided from the wing-root intake, the shape indicated by the bracing rods between the fuselage and the large inner wing rib, into the central fuselage to feed the Nene engine's prodigious (for the time) mass-flow requirements.***

BELOW ***The forward fuselage section from a port three-quarter view, with the majority of the frames now in place. Armament was included on the second and third N.7/46 prototypes; VP413 was the first to be equipped with the planned four 20mm Hispano cannon in the underside of the nose, two of which may be seen midway along the section. Note the hollow in the frames adjacent to the gun bay to allow clearance for the cannon's blast tubes. The upper half of the sub-assembly is open, as this is where the cockpit will ultimately be sited.***



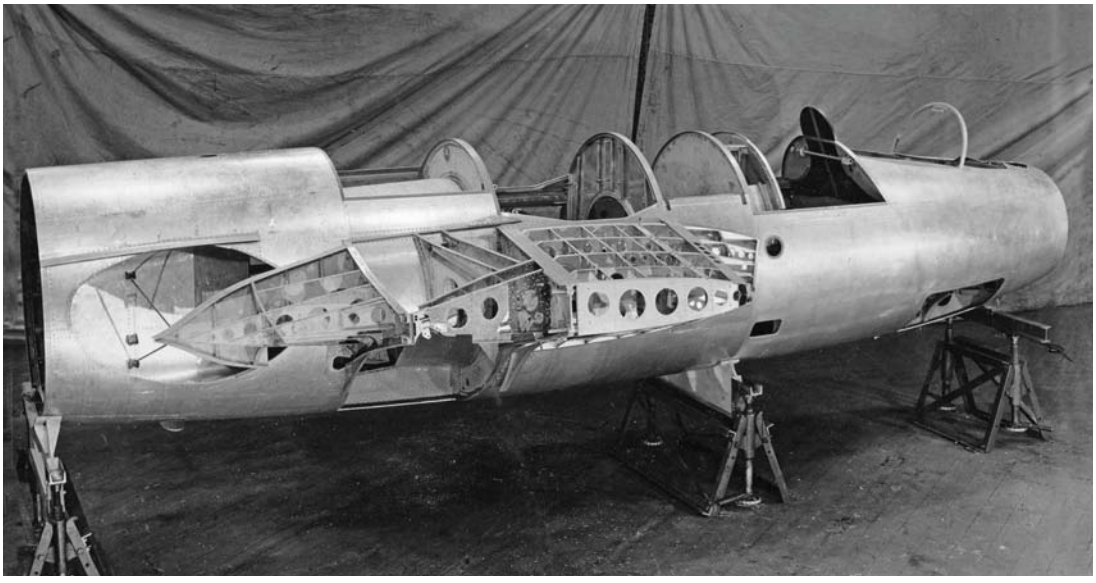


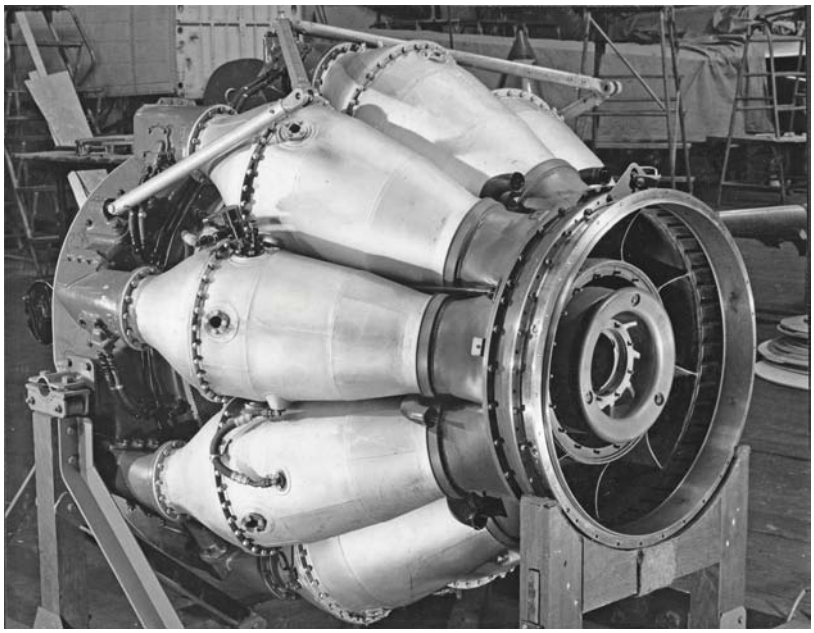
LEFT ***The rear fuselage was relatively simple compared with the central and nose sections, both of which had to incorporate a great deal of equipment and house major items such as the engine and cockpit. Here the light ring-frames have been positioned in the jig, running aftwards from left to right. Note the transition from those furthest forward, which are of a broadly circular cross-section, to much thinner oval-section frames at the aft end. The semi-monocoque rear fuselage structure consisted of a total of 15 of these light frames and 16 stringers supporting the skin.***



LEFT ***Rather than the longerons and stringers for the rear fuselage being connected directly to the frames before skinning, a number of pre-formed sections of outer skin with stiffening already attached were built up and fitted to the frames after their assembly. This is the lower fuselage section; but all the skin panels were of similar form, with hatch openings pre-cut, as seen here.***

BELOW ***The forward fuselage has now been joined to the nose section, and skinning has begun. Note the oval-shaped recess behind the trailing edge of the wing root, through which the starboard section of the bifurcated jetpipe exited. The main undercarriage bay is visible beneath the aft part of the wing-root. The sloping bulkhead towards the nose, with the protruding half-circle at the top, would have the pilot's ejection-seat rail attached to it. The half-hoop at the forward end is the aft frame for the windscreen, which was integral to the nose section. The open rectangular panel beneath it incorporated access to the guns' blast tubes.***

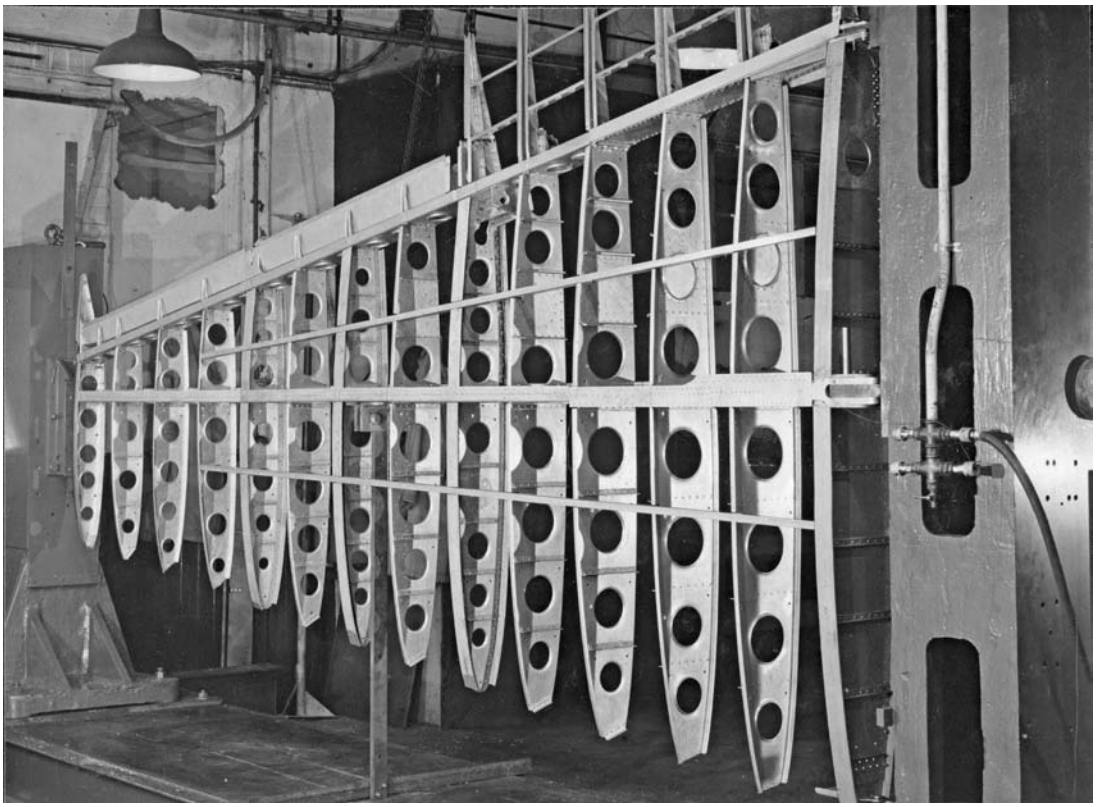


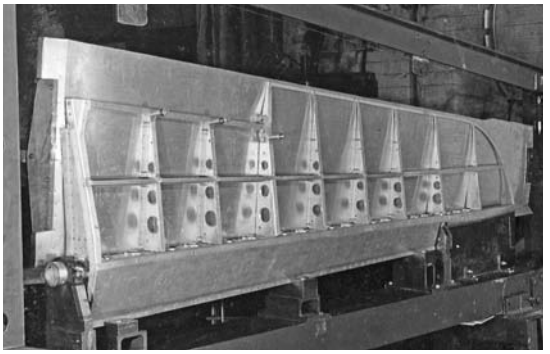


RIGHT ***The Rolls-Royce B.41 engine, known in production as the Nene, was essentially a version of the same company's Welland, scaled-up and improved via lessons learned from the USA's General Electric/Allison J33. The Hawker P.1035/P.1040 was designed around the engine, which became the most powerful jet in production for a spell in the late 1940s. The engine is seen here from the port rear side. A manifold would be attached to the aft end of the engine, to which each jetpipe would be fitted. The jointed tubes at the top of the engine were part of the N.7/46 installation; the sockets at the rear attached to fittings on a ring frame inside which the engine sat.***

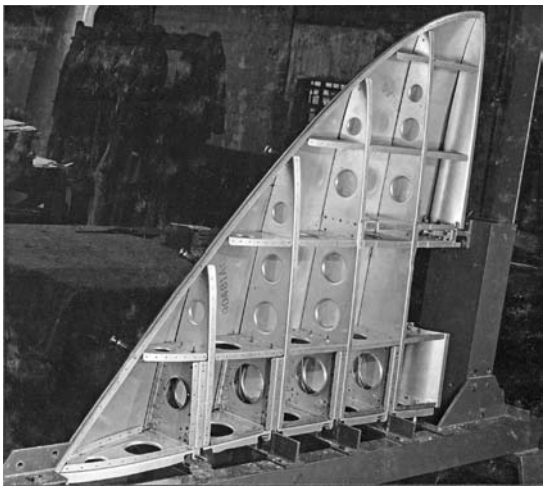
RIGHT ***Parts of the characteristic twin jetpipes, central to the N.7/46's design, developed by Rolls-Royce and Hawker specifically for the type. Note how they curve, initially splaying outwards before bending inward to direct the jetflow more in line with the aircraft's axis. The rear of the jetpipe is closest to the camera on the left-hand item (marked "STBD", i.e. starboard) and furthest from the camera on the right-hand jetpipe.***

BELOW ***The pre-skinned rear fuselage section has now been mated to the central fuselage, and the main structure is complete. The base of the fin was integral with the fuselage, as the tail was of cruciform design with the tailplane mid-mounted on the fin — a compromise between raising it clear of the jetwash and avoiding the higher weight associated with a T-tail. Note the frames of another N.7/46 in their jigs in the background — possibly the third prototype, VP422.***





ABOVE ***The mainplane structure of the N.7/46, which was a notable advance on the preceding Sea Fury in several respects. The almost total lack of stringers is evident here, with stiffness imparted instead through a thicker-gauge skin, a practice learned from American manufacturers during British engine genius Roy Fedden's mission to the USA during the Second World War. The straight leading and trailing edges simplified manufacturing, while the "high-speed" aerofoil — with maximum thickness at around 40 per cent chord (note how far aft the main spar is) and a 9·5 per cent thickness to chord ratio (compared with 14 per cent for the Sea Fury) — significantly improved performance.***



ABOVE LEFT ***An N.7/46 elevator in its construction jig, showing generally similar construction to the mainplanes. Note the elevator's curved outboard end; this feature was only included on the prototypes, and production elevators were square-ended. The forward edge shows the balance and flange for the aerodynamic "seal strip", which prevented air leaking between the upper and lower surfaces of the tailplane.***

LEFT ***The fin, with its starboard face skinned, showing its longitudinal and vertical ribs. The slot in the trailing edge housed the rudder's balance tab. This is only the upper part of the fin; as described on the previous page, the lower part was integral with the fuselage and the curvature of the lower edge corresponds to the upper surface of the tailplane.***

The author would like to thank Colin Dodds, and the Editor would like to thank Fred Crosskey, for their help with the preparation of this feature. For an excellent guide on building a rather smaller Sea Hawk, see Guideline Publications' **Warpaint No 29** ***on the type. For more information visit the website at www.guidelinepublications.co.uk***

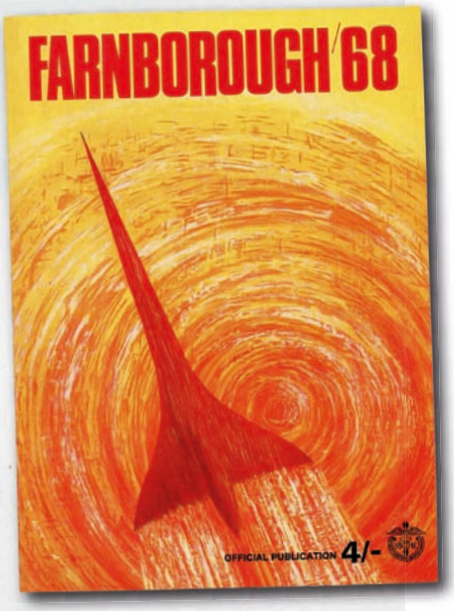
ABOVE ***The finished article — a fine Cyril Peckham study of WF144, the second production example of the Sea Hawk F Mk 1. Only 35 Sea Hawks were produced by Hawker (apart from the prototypes) before production moved to Armstrong-Whitworth at Baginton. This aircraft differed from the prototypes by having square-ended elevators, a redesigned cockpit canopy and a longer arrester hook; otherwise it was very similar, lacking features of later production aircraft such as the "acorn" fairing at the intersection of the fin and tailplane and underwing weapon hardpoints.***

BELOW ***Although it is not specified in the material, it is likely that the aircraft seen being constructed in the preceding photographs was the second N.7/46 prototype, VP413 — which, unlike the first, included folding wings, catapult spools and full gun armament. The aircraft made its maiden flight on September 3, 1948, after which it went to Boscombe Down for dummy deck assessment trials. It was then flown on to*** **HMS Illustrious**, ***aboard which it is seen here, for take-off, landing and general handling trials.***

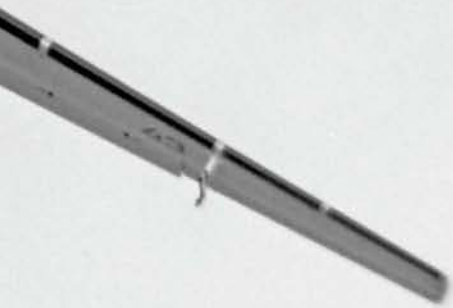
TAH ARCHIVE

THREE DEADLY MINUTES

THE BREGUET ATLANTIC TRAGEDY AT FARNBOROUGH, 1968



ABOVE ***The 26th SBAC show was held at Farnborough during September 16–22, 1968, and, as the programme (as seen here) noted, was marked by the public debuts of several new British types, including production examples of Hawker Siddeley's Harrier and Nimrod, the Handley Page Jetstream and the Beagle Pup.***



MAIN PICTURE ***With the propeller of its port Rolls-Royce Tyne engine feathered, and the undercarriage extended,*** **Aéronavale** ***Breguet Atlantic serial "43" was captured by the author performing its final, fatal display routine on September 20, 1968. Moments later the aircraft lost all flying speed and sideslipped into the Black Sheds at the eastern end of Farnborough's runway.***

In September 1968 **RICHARD T. RIDING** was plying his trade as an aviation journalist and photographer at the SBAC show at Farnborough when, to his horror, in the middle of its display, the Breguet Atlantic plummeted into the airfield's famous Black Sheds. He digs deep into the archives to reveal a catalogue of errors made by a pilot who committed the cardinal error of deviating from his own plan . . .

HELD LATER THAN usual to avoid clashing with a bank holiday, the 1968 Society of British Aircraft Constructors (SBAC) show at Farnborough took place during one of the wettest Septembers on record. Such were the downpours that the nearby Basingstoke Canal broke its banks, and it was reported that fish had been caught on Farnborough's runway!

The once-annual show had become a biennial event in 1964 and, two years later, less parochial when foreign exhibitors were welcomed for the first time, provided that their products incorporated a substantial amount of British equipment. Thus the 1968 show included many foreign aircraft, among them Japan's NAMC YS-11A turboprop airliner, making its European debut, the single-seat Soko Jastreb light-attack jet and two-seat Galeb trainer, from which it was derived, built in what was then Yugoslavia, and the Fokker F.27 Friendship in an eye-catching orange paint scheme. It was a French participant, however, that hit the headlines late on Friday September 20 — and for all the wrong reasons.

THE ATLANTIC

The Breguet Br 1150 Atlantic long-range maritime patrol aircraft was a Nato replacement for the Lockheed P-2V Neptune anti-submarine and reconnaissance aircraft. The prototype Atlantic made its maiden flight at Toulouse on October 21, 1961, deliveries to the French and German navies beginning in 1965. The installation of two Hispano-built Rolls-Royce Tyne RTy 20 Mk 21 turboprop engines were its qualification for participation in the SBAC show, and in July 1968 the *Aéronavale* base at Nîmes-Garons was instructed to provide an example for demonstration at Farnborough.

Initially, *Capitaine de Corvette* (CC) Hervé Chevalier, Commander of No 22 Flotilla, was selected as the aircraft's captain for the entire week, with CC Jean Saint-M'Leux, former Commander of No 21 Flotilla, as second pilot. In the event Chevalier was available only for the first few days of the show, Saint-M'Leux being scheduled to take command from Thursday September 19. Although Saint-M'Leux had not flown since July that year he had amassed 6,763 flying hours — including some 2,550 hours on the Atlantic — having performed most of the type's Aéronavale acceptance trials. Saint-M'Leux was also no stranger to Farnborough, having displayed the Atlantic there during the 1966 SBAC show.

With* Capitaine de Corvette *Jean Saint-M'Leux at the controls in the right-hand seat, Atlantic "43" is positioned before take-off on its final flight. The pilot opted to take what is customarily the copilot's seat as the display routine included mostly turns to starboard, for which the right-hand seat would provide better visibility from the cockpit.

RICHARD T. RIDING

On Tuesday September 17 and Wednesday the 18th the reduced crew of five (normally 12) was under the command of Chevalier, who occupied the right-hand seat during the display, an arrangement put in place to give the captain a better view of the airfield during the predominantly right-hand pattern. Copilot C.M. Durand, also very experienced, occupied the left-hand seat. Also on the flightdeck was flight engineer 2e *Maître* A.C. Goasguen, with navigator E.V. Lemaire and *Maître* Bequier, in charge of electronics, occupying their stations in the fuselage.

The Atlantic's 5min display sequence flown by Chevalier was divided into four segments:

■ Take-off — retract undercarriage — 40° bank to starboard — maintain turn until downwind on reciprocal heading to runway — feather port propeller — extend undercarriage — initiate 45° bank to starboard until aligned along displaced line (referred to as the "turn-safety line") parallel to runway in direction of take-off;

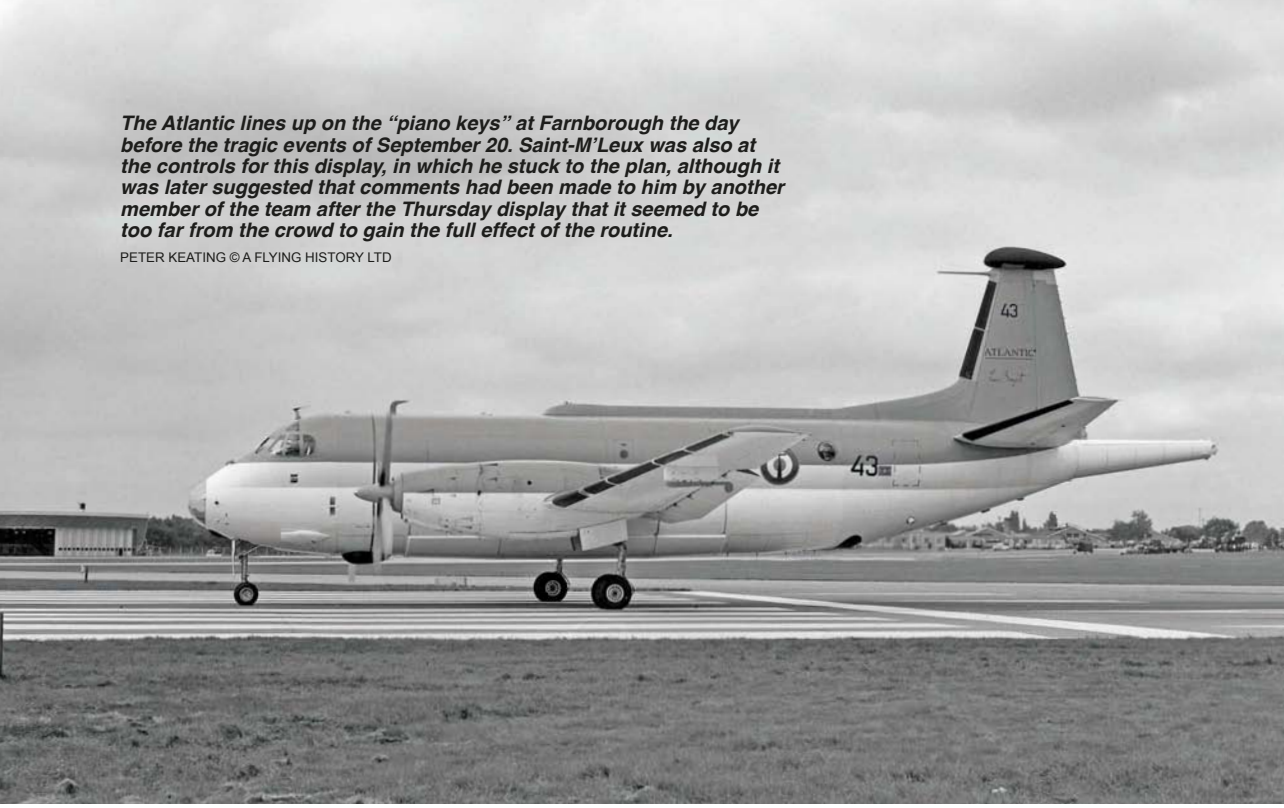
■ flypast along turn-safety line at 150ft (45m) with undercarriage down and port prop feathered — retract undercarriage — turn to starboard to 200ft (60m) altitude — maintain starboard turn 270° to face crowdline;

■ unfeather port prop — open bomb bay on run towards crowd — turn to port to run along turn-safety line — extend radome — turn to port (towards "Black Sheds" located at the eastern end of the airfield) — engine lit fully during this turn — continue turn to a point parallel with centre of runway, facing westward;

■ continue turn to port to face crowd — continue turn over turn-safety line — close bomb

BELOW ***Directly preceding the Atlantic in the display order was Royal Navy McDonnell Douglas Phantom FG.1 XT859 of Yeovilton-based No 700P Sqn, whose CO, Cdr Anthony Pearson, was at the controls, with Lt-Cdr Davis in the rear seat. As the Phantom touched down, Saint-M'Leux prepared to begin the Atlantic's 5min display routine.***

RICHARD T. RIDING



The Atlantic lines up on the "piano keys" at Farnborough the day before the tragic events of September 20. Saint-M'Leux was also at the controls for this display, in which he stuck to the plan, although it was later suggested that comments had been made to him by another member of the team after the Thursday display that it seemed to be too far from the crowd to gain the full effect of the routine.

PETER KEATING © A FLYING HISTORY LTD

bay doors — retract radome — straighten for final turn for landing — select full flap — extend undercarriage — steep bank to starboard for "teardrop" approach to final spot landing.

This sequence was different from the 7min slot flown by the Atlantic at a display at Turin that June, which was abbreviated to conform to the shorter time allocation at Farnborough. Two rehearsals were flown by Chevalier on Saturday the 14th and the first display proper was flown by him on Tuesday the 17th. The following day Saint-M'Leux arrived in the morning and flew in the Atlantic in the afternoon as an observer, standing behind the pilots during Chevalier's display routine.

On Thursday the 19th Saint-M'Leux flew as captain, following the planned routine to the letter, although it was noted that he ended the routine with a rather heavy landing. Just before 1500hr on Friday the 20th Saint-M'Leux taxied out to begin his second display as captain, having flown the Atlantic at Farnborough for a limited time only up to that point.

THROUGH A LENS DARKLY

With a strong wind buffeting my back I had just photographed prototype Handley Page Jetstream G-ATXH and Royal Navy McDonnell Douglas F-4 Phantom XT859 when I turned my camera towards the whistling Rolls-Royce Tynes of Atlantic serial "43", as Saint-M'Leux awaited take-off clearance from air traffic control.

At 1510.40hr, 40sec later than scheduled, Saint-M'Leux lifted the gull-grey and white Atlantic off the runway into an immediate steep climbing turn. With the undercarriage still extended, the aircraft turned 180° and flew past me downwind in the direction of the famous Black Sheds. After another turn to starboard, the Atlantic completed the first flypast down the runway in the direction of the take-off, although the undercarriage, which was supposed to be retracted during this run, remained down.

Further deviations followed. Following another bank to turn 180° for its second downwind pass, parallel with the runway but nearer the crowd and with its port prop feathered, the Atlantic turned towards the crowd further east than on the previous day, as though influenced by the 30kt wind. It also appeared to be flying slower than the previous day as it banked to port to turn towards the Black Sheds. The bank steepened appreciably, the Atlantic beginning to lose height as the port propeller began to unfeather. Things were not looking good and then, as if in slow motion, the aircraft sideslipped into the ground, seemingly disappearing behind the Black Sheds. A split second later a crimson fireball sent a massive plume of black smoke ballooning into the Hampshire sky. The Atlantic was just 2min 50sec into its 5min sequence.

Display commentator Charles Gardner handled the situation perfectly, warning the crowd: "There is nothing I can do, and there is nothing you can do. For the Lord's sake, don't go near it". With the eastern sky blackened by billowing smoke, fire trucks and water-carrying

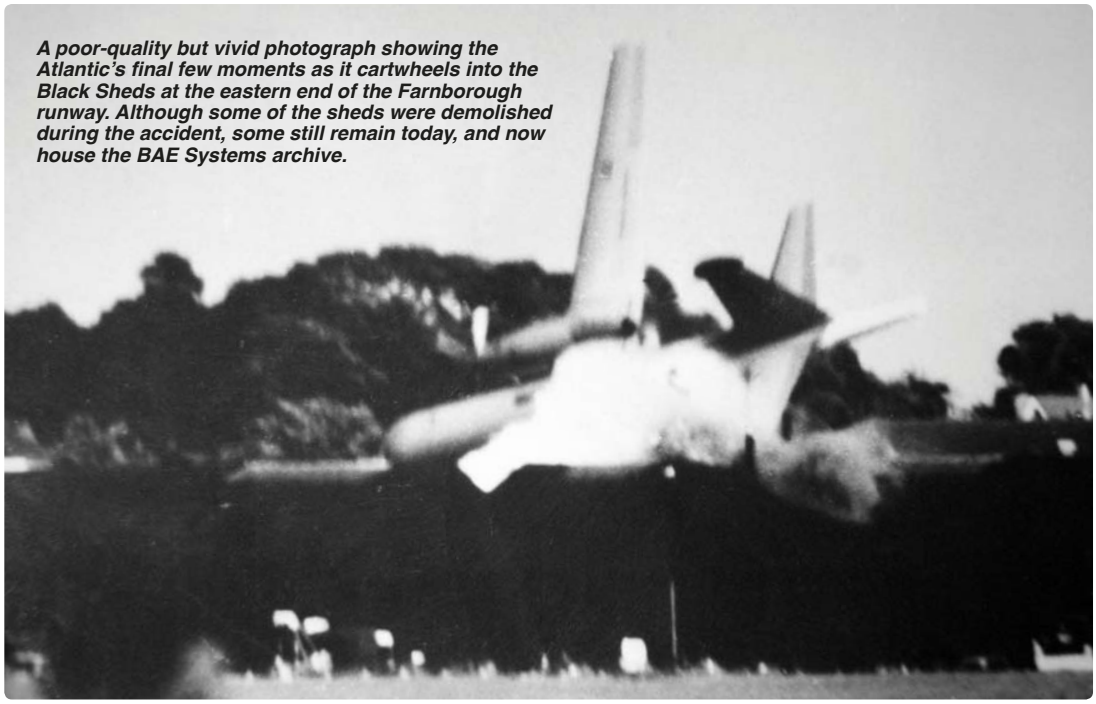
RICHARD T. RIDING x 2

LEFT *Taken during one of the preceding days' displays, this photograph shows the Atlantic with its undercarriage retracted and with its bomb-bay doors open and forward-fuselage radome extended, as per the planned routine. During the Friday display the undercarriage remained down throughout, the radome was never extended and the bomb-bay doors were not opened. It appears that by this point on the Friday, Saint-M'Leux had all but abandoned the planned routine and was already struggling with an aircraft that was lower and slower than it should have been, with its pair of Tynes delivering asymmetric amounts of power.*

RIGHT *Probably taken during the same display as the photograph above, this image shows the Atlantic with its undercarriage extended and the port propeller feathered during its first run along the turn-safety line after take-off.*

BELOW *The Atlantic begins its turn to starboard after lifting off from the Farnborough runway. The type bristled with electronic equipment for its maritime patrol role; note the distinctive magnetic-anomaly detector (MAD) tailboom.*

BRIAN TURPIN



A poor-quality but vivid photograph showing the Atlantic's final few moments as it cartwheels into the Black Sheds at the eastern end of the Farnborough runway. Although some of the sheds were demolished during the accident, some still remain today, and now house the BAE Systems archive.

TNA AIR 20/12163

helicopters were immediately on the scene, but they could only contain the fire, not douse it. With the briefest of pauses, the flying continued, an Agusta-Bell 205BG helicopter being followed by the YS-11A, the latter ending its slot by landing through the smoke.

Within minutes Frederick H. Jones, chief experimental officer and head of the RAE's Accident Investigation Section, was on the scene, but could achieve little until the fires had been controlled and the area made approachable a couple of hours later.

On impact the aircraft had broken up into mainly large sub-assemblies and smaller components, covering a triangular area approximately 200yd x 50yd along a mean bearing of 030° (roughly north-east), damaging a number of buildings and vehicles in its path. Fire destroyed much of the fuselage and centre-section. The Atlantic's port wing had hit first, the portion outboard of the engine detaching and ending up 170ft (52m) from the main wreckage. The tail unit had also detached on impact and "flew" 625ft (190m) on to the roof of the Royal Aircraft Establishment (RAE) Mess in RAE Road.

In addition to the Atlantic's five crew, RAE labourer Frederick Gould, sitting in the RAE Mess, happened to be in the wrong place at the wrong time and was also killed. Three civilians suffered slight injuries and about a dozen or so other RAE personnel were slightly hurt or suffered shock. Had the Atlantic been carrying its full complement of 12 souls the death toll would have been even greater.

The following day, hampered by rubble and fallen masonry, Jones supervised the difficult task of removing the wreckage to a nearby safe compound before its ultimate transfer to the accident hangar. Clearing of the wreckage was completed by the evening of Wednesday September 25, ready for examination to begin.

ABOVE ***This press photograph shows the ensuing fireball from a nearby car park. The*** **Daily Mirror's** ***front page the following morning led with a picture of the fireball and the inevitable headline "Inferno at the Air Show — One-engine Display Ends in Disaster".***

Damage and destruction on the ground was considerable. The combined cost of replacing buildings destroyed and repairing those that had been damaged amounted to more than £60,000. A dozen or so Bedford, Morris and Ford vans and trucks valued at a total of £3,650 were destroyed and estimated costs of £4,200 were set aside for repairing other damaged vehicles. Loss of equipment and tools accounted for more compensation. The cost of removing the wreckage and clearing the site amounted to nearly £5,000. The popular press, ever mindful of the "human interest" angle, reported that a Mr East had lost both his pedigree boxer bitch and his Austin A40 car in the crash.

ESTABLISHING A CAUSE

So what had gone wrong? For a start, Saint-M'Leux's demonstration differed from that of Chevalier's sequence on previous days, and ran as follows:

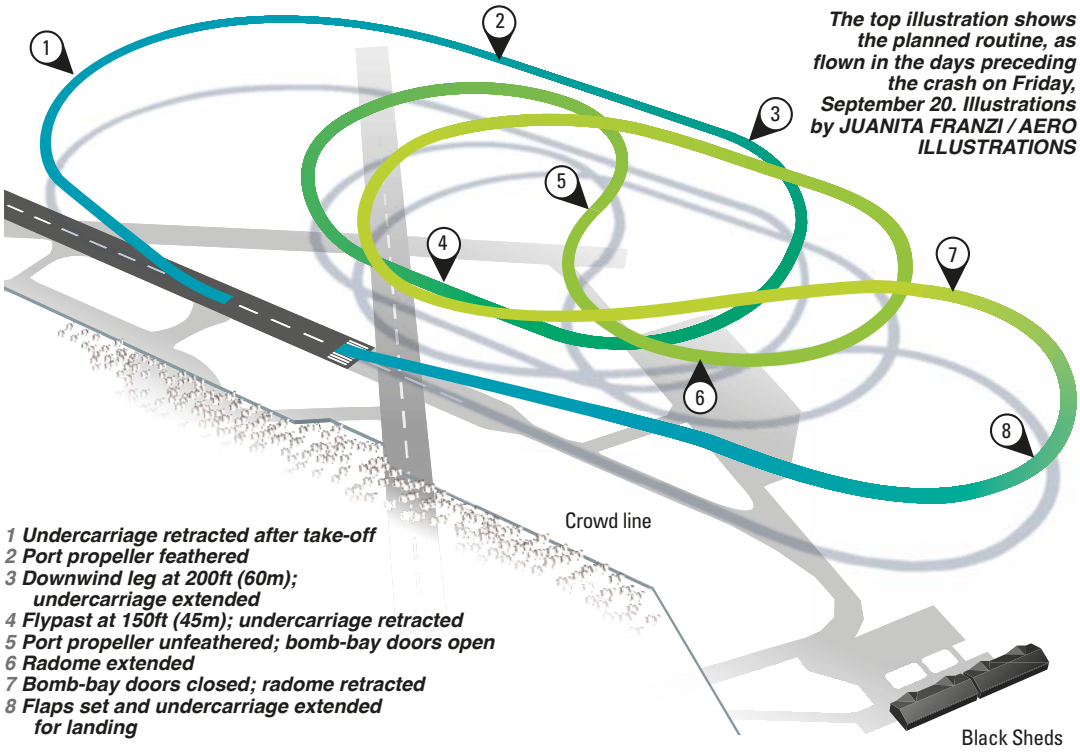
- shorter take-off — undercarriage NOT retracted — steeper bank to starboard — port prop feathered (as per planned routine) — 360° starboard turn maintained until aligned with runway (not the turn-safety line located further from the crowdline);
- pass along runway in direction of take-off with port propeller feathered (as per plan) — turn to starboard (as per plan) — port prop still feathered — aircraft lower and slower, and further east than previous displays;
- turn maintained 270° until facing crowd (as per plan) — roll to port — port prop unfeathered and begins to rotate — roll wings level;
- roll to port (possibly uncommanded or unintentional) increases to 60° over eastern end of the runway — roll continues slowly with airspeed dropping, leading to high sink rate;
- aircraft loses lift and strikes the roof of one of the Black Sheds.

Thus Saint-M'Leux's display comprised one take-off; one circuit; one flypast with feathered port prop; another circuit round towards the crowd, followed by a roll to port, at which point the combination of low airspeed, asymmetric power and the extended undercarriage led to a departure from controlled flight.

While the pall of thick black smoke continues to climb and starts drifting northwards, emergency vehicles rush to the scene of the crash; a Westland Scout carrying a hopper of water or fire-retardant returns from the Black Sheds to pick up another load. In marked contrast to air events today, the aircraft display programme continued shortly afterwards. RICHARD T. RIDING

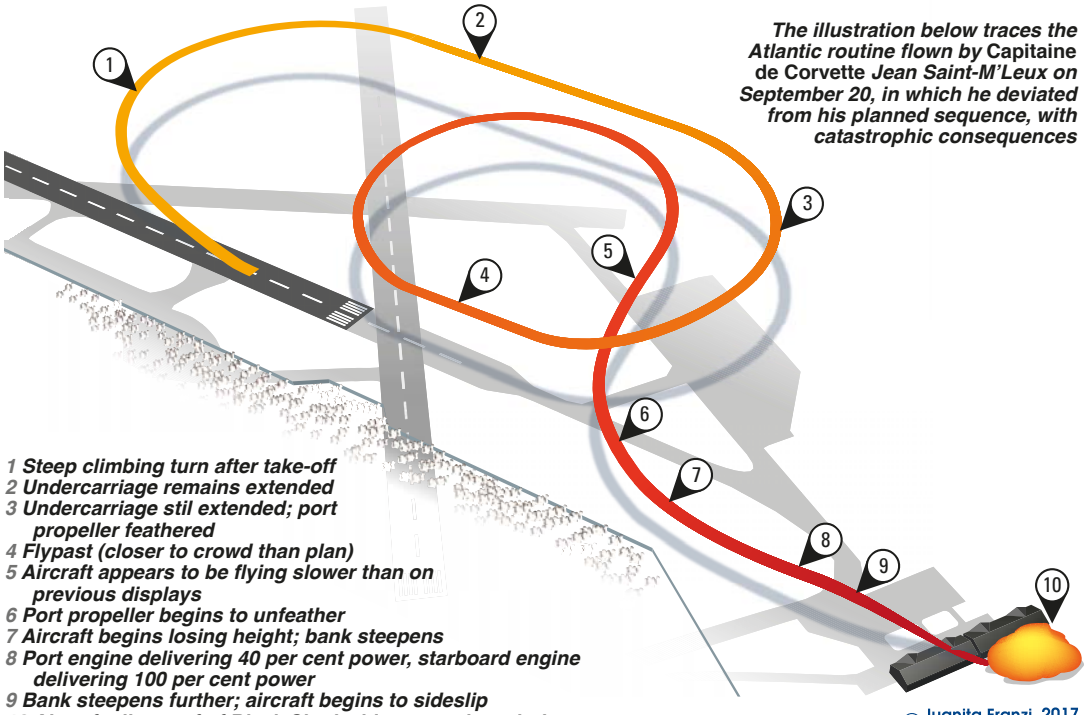
THE CRASH OF BREGUET ATLANTIC SERIAL "43" AT THE SBAC SHOW, FARNBOROUGH, SEPTEMBER 20, 1968

The top illustration shows the planned routine, as flown in the days preceding the crash on Friday, September 20. Illustrations by JUANITA FRANZI / AERO ILLUSTRATIONS



1 Undercarriage retracted after take-off
2 Port propeller feathered
3 Downwind leg at 200ft (60m); undercarriage extended
4 Flypast at 150ft (45m); undercarriage retracted
5 Port propeller unfeathered; bomb-bay doors open
6 Radome extended
7 Bomb-bay doors closed; radome retracted
8 Flaps set and undercarriage extended for landing

The illustration below traces the Atlantic routine flown by Capitaine de Corvette *Jean Saint-M'Leux on September 20, in which he deviated from his planned sequence, with catastrophic consequences*



1 Steep climbing turn after take-off
2 Undercarriage remains extended
3 Undercarriage stil extended; port propeller feathered
4 Flypast (closer to crowd than plan)
5 Aircraft appears to be flying slower than on previous displays
6 Port propeller begins to unfeather
7 Aircraft begins losing height; bank steepens
8 Port engine delivering 40 per cent power, starboard engine delivering 100 per cent power
9 Bank steepens further; aircraft begins to sideslip
10 Aircraft clips roof of Black Sheds, hits ground, explodes

TAH ARCHIVE

ABOVE ***Japan's Rolls-Royce Dart turboprop-powered NAMC YS-11, JA8714, lands through the smoke in the aftermath of the Atlantic crash, the first fatal accident at the SBAC show at Farnborough since the shocking break-up of the de Havilland D.H.110 during a display by John Derry in 1952, as a result of which 29 spectators were killed.***

The pre-flight inspection that day had revealed no technical snags, although earlier in the week there had been a minor problem with the right-hand pilot seat's fore-and-aft travel mechanism, preventing the seat from locking properly in the selected position. This was duly rectified and had not recurred on subsequent flights. Post-crash examination revealed that both pilots' seats were locked securely.

Post-crash examination also revealed no evidence of external structural failure. After the bank steepened following the final roll to port it appeared that the captain's attempt to level the aircraft was made too late. The aircraft's configuration on impact was as follows: undercarriage down; flaps lowered to 12° position; airbrakes closed; rudder and elevator settings not determined; starboard aileron in full "up" position with associated spoilers out. At the moment of impact the port engine was developing 40 per cent of take-off power and increasing, while the starboard engine was developing full take-off power. Both throttle levers were thought to have been at "full".

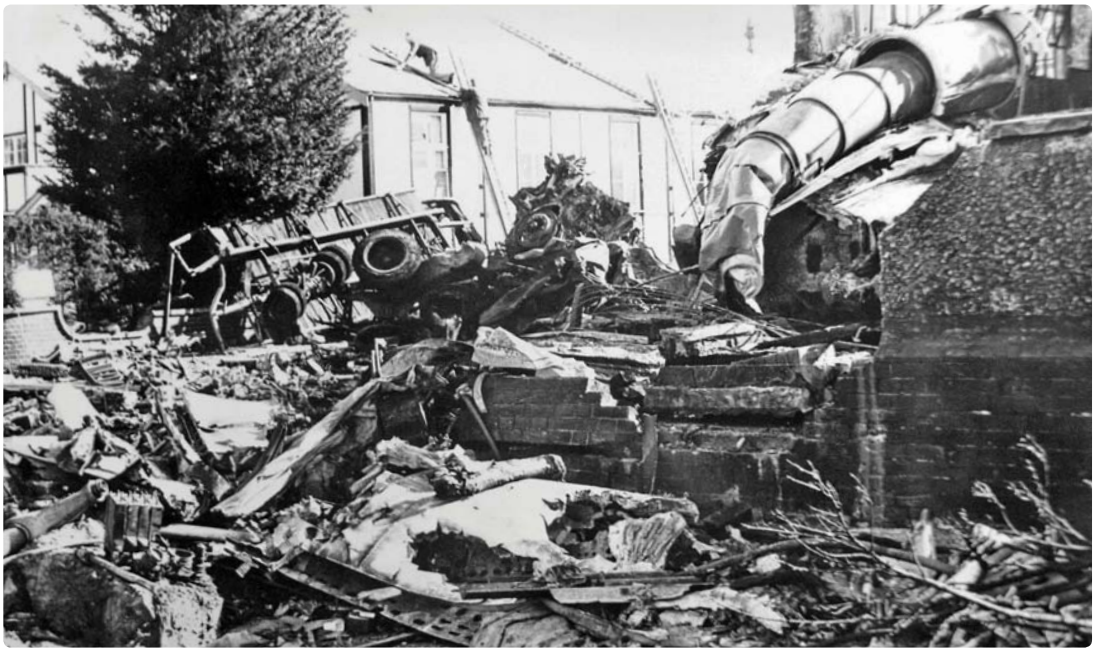
The Board of Enquiry set up to investigate the accident included representatives from the Aeroplane & Armament Experimental Establishment at Boscombe Down, France's *Ministère de la Marine*, RAE Farnborough, Capitaine Chevalier and Frederick Jones. Examination of the wreckage ruled out any kind of pre-crash failure or defect likely to have affected the flight. As part of its findings as to the causes of the accident the Board noted:

"As a result of the undercarriage having been left extended, it is possible that the air speed at the time of unfeathering the port prop was less than normal, and less than intended by the pilot. This in itself would not have resulted in an accident. Possibly because of [a] control jam, the rudder deflection necessary at this speed to balance the asymmetric thrust of the starboard engine and the drag of the unfeathered port propeller, was not applied. This was the most important cause, and allowed yaw, sideslip and roll to develop to the extent that the pilot had inadequate control of the port turn which he had initiated. The aircraft's height and speed were insufficient to permit recovery by a reduction of power on the starboard engine. Bank therefore increased beyond the point at which level flight could be sustained, and the aircraft stalled in the turn and crashed."

STICK TO THE PLAN

Lastly, here are my personal thoughts as to why this tragedy occurred. As one of the most experienced Atlantic pilots, with 2,550 hours on type, Saint-M'Leux perhaps departed from the set sequence in order to show his exceptional mastery of the aircraft and "spice up" the demonstration. Failure to retract the undercarriage could not have been twice forgotten on the same flight by both pilots and it is possible that Saint-M'Leux deliberately left the undercarriage down in order to make his demonstration appear more impressive.

The Board of Enquiry doubted that the



ABOVE ***The wreckage of the Atlantic after the fires had been put out. Frederick Jones surmised that "it was not possible to determine a specific speed for the aircraft at the moment of impact, but a general assessment of the nature of the disintegration of the aircraft . . . would categorise it as 'low speed', of the order of about 100–150kt".***

extended undercarriage was due to a malfunction; examination of the wreckage revealed that the override button for the "up" selector had not been used. The difference between the planned feathered-prop flight down the turn-safety line and the course taken by Saint-M'Leux nearer the crowdline was possibly done to impress. Indeed, the official report stated that "the different line taken on the single-engined flypast could have been a mental aberration or, which the Board considers more likely, a reaction to the suggestion by a member of the team that the previous day's display had been too far from the crowd". Saint-M'Leux began his turn to port at the eastern end of the runway early, turning into an engine that was not developing full power. With the strong wind, turning to complete the circuit to face the crowd again would have required an impossibly steep turn, leading to things going badly awry.

One suggestion made by the Board was that the pilot had abandoned his planned display by this point. This is supported by the fact that the bomb-bay doors and radome were not extended during the turn to port as per the plan, suggesting that, with the undercarriage also still down, the pilot did not want to risk further drag. Significantly, but perhaps curiously, no radio calls were received from the aircraft after acknowledgement of take-off clearance.

Almost 50 years later, the truth is that we will never know what actually took place in that cockpit during the final seconds of those deadly three minutes.

TNA AIR 20/12163 x 2

ABOVE ***The severed port wingtip of the Atlantic in its final resting place among the Black Sheds. Jones's examinations of this piece of wreckage concluded that the port wing had been moving upward relative to the horizontal plane, suggesting that the aircraft was rolling to starboard at the time of the initial impact.***

ACKNOWLEDGMENTS *The Editor would like to thank Tony Blackman and Sir Charles Masefield for their invaluable help during the preparation of this article*

LAST DAYS OF THE CONDOR

THE FOCKE-WULF Fw 200 IN LUFTWAFFE SERVICE, 1944–45

Described by Winston Churchill in the dark early days of the Second World War as the "Scourge of the Atlantic", the far-ranging Focke-Wulf Fw 200 Condor was well past its prime by 1944. Luftwaffe specialist **CHRIS GOSS** describes the type's final year in combat, during which its ultimate transformation from bird of prey to sitting duck was made complete

BY 1944 THE Focke-Wulf Fw 200 Condor had all but exceeded its sell-by date. At the end of November 1943, at long last and very late, the aircraft that would replace it as a long-range maritime reconnaissance and bomber aircraft, the Heinkel He 177, had become operational, despite its performance still being well below what was required. As a result, the ever-diminishing number of Condors would be required to soldier on for a while longer.

The only units that were still flying the Fw 200 in January 1944 were elements of *Kampfgeschwader 40* (KG 40) namely 3 Staffel/KG 40, commanded by the experienced *Hauptmann* Robert Maly, which was subordinated to III Gruppe/KG 40 commanded by Hptm Dr Lambert von Konschegg. Maly's unit was generally based in Norway while III Gruppe was based in south-west France.

January 5, 1944, saw a bad start to the year when frequent target Bordeaux-Mérignac airfield was bombed again, resulting in the destruction of some eight Condors with another three damaged. The first loss on operations then occurred less than two weeks later, on January 17, when the Condor commanded by *Oberleutnant* Ernst Rebensburg of 3./KG 40, operating out of Norway, failed to return from a reconnaissance sortie over Norway and Iceland.

With Allied air superiority on the increase, Condors in France were proving easy prey for RAF and USAAF long-range fighters. The first such Fw 200 loss of 1944 occurred on January 27, when Flt Lt Charles Scherf and Fg Off Al Brown in a de Havilland Mosquito of No 418 Sqn RCAF shot down a Condor of 9./KG 40 near Avord in central France, resulting in the deaths of *Oberfeldwebel* Willi Schmidt and four crew. The RAF combat report relates what happened:

"A Fw 200 was seen 12 miles [19km] ahead, south-east of Avord going west; Flt Lt Scherf turned sharply to starboard and attacked from astern, range 500yd, height 300ft [90m]; 7–8sec burst, strikes on port wing moving forward to fuselage; under-part of fuselage caught fire; Wg Cdr D.C.S. Macdonald took cine-camera shots.

"Pieces flew off and enemy aircraft levelled out. As pilot was baling out, Wg Cdr fired at enemy aircraft and engine burst into flames; enemy aircraft crashed in wood, 1630hr."

The last successful shipping attack by a Condor occurred at 1055hr on February 10, 1944. Three Fw 200s of 3./KG 40, led by Maly, flew over Seydisfjordur in eastern Iceland at 4,700ft (1,430m), dropping three bombs on ships in the harbour, one of the bombs exploding on the bow of the British oiler *El Grillo*. There were no casualties as a result of the attack but the *El Grillo* sank later the same day.

BLOODY BISCAY

The first Fw 200 combat loss over the Bay of Biscay occurred on February 12, 1944, when up to six Condors took off to attack a convoy 400 miles (640km) west of Cape Finisterre. In one of the Condors, flown by Oblt Günther Seide of Stab (HQ Flight) III./KG 40, was *Unteroffizier* Werner Zerrahn, who recalls:

"We had taken off with about five or six aircraft and on our way out we spotted some twin-engined 'planes starboard ahead, assuming it would be our own escort of [Junkers] Ju 88s from I./ZG 1. However, these 'planes now took an attacking position by flying a steep turn, and we realised they were enemy aircraft. As far as I remember, we were only attacked once; we escaped with minor damage. I suffered a bullet graze to my left foot and Fw Günther Hickmann, a radio operator in another aircraft, took a bullet through his left hand. On the ground we found out that we'd had a lot of luck, because we counted 130 bullet holes in our Condor."

Zerrahn and his fellow Condor crew members had indeed been lucky, having been intercepted by three Mosquitoes of No 157 Sqn. Pilots Flt Lts Dick "Dolly" Doleman and Brian Whitlock and Fg Off Verdun Hannawin each shared the destruction of one Condor, which was flown by *Feldwebel* Karl-Heinz Schairer of 7./KG 40; he and his seven crew were all reported missing. Werner Zerrahn was probably wounded by Verdun Hannawin; the RAF combat report shows how one-sided the combats were:

"Doleman sighted aircraft on the starboard beam about four miles [7km] away and the three

OPPOSITE PAGE ***Originally designed as a long-range airliner, the Fw 200 prototype made its first flight on July 27, 1937, pre-production examples of the type demonstrating its remarkable range capabilities with a series of record-setting long-distance flights. This Fw 200C-4 military variant is seen at Værnes, Norway, in 1942.*** VIA AUTHOR

Mosquito XIX MM654 only ever operated with No 157 Sqn, and is seen here bearing the unit's RS code, in this case RS-N. On February 12, 1944, when three of its Mosquitoes attacked a formation of III./KG 40 Fw 200s over the Bay of Biscay, No 157 Sqn was operating on long-range sorties from Predannack in Cornwall.

ALL PHOTOGRAPHS VIA AUTHOR UNLESS OTHERWISE STATED

Mosquitoes turned starboard towards them. The aircraft were seen to be five Fw 200s, four in 'V' formation and one straggling, flying at zero feet; our aircraft attacked from starboard in line astern, each opening fire at about 900yd, closing to 600yd. Strikes were scored on at least one enemy aircraft, the last on the starboard side of the V; Flt Lt Doleman broke away to port, the other two to starboard. Doleman and Hannawin re-formed and attacked again from the starboard quarter. As Flt Lt Doleman attacked, the inner starboard engine of the enemy aircraft damaged in the first attack caught fire and fire also broke out on the starboard side of the fuselage.

"When Fg Off Hannawin attacked, the flames spread all over the wing; the enemy aircraft made a gentle turn to starboard, lost height, hit the sea and immediately blew up. In the course of this attack, Fg Off Hannawin also scored strikes on the other aircraft on the starboard wing of the enemy formation; Fg Off Hannawin made two more attacks on the remaining four aircraft before setting course for base."

Encounters at sea were by now becoming rare for the Condors, RAF Coastal Command recording only three uneventful encounters with Fw 200s in 1944, these being off the Shetlands and over the Bay of Biscay. Meanwhile, Allied intruder attacks continued to result in losses of Condors and personnel.

STALKING THE CONVOYS

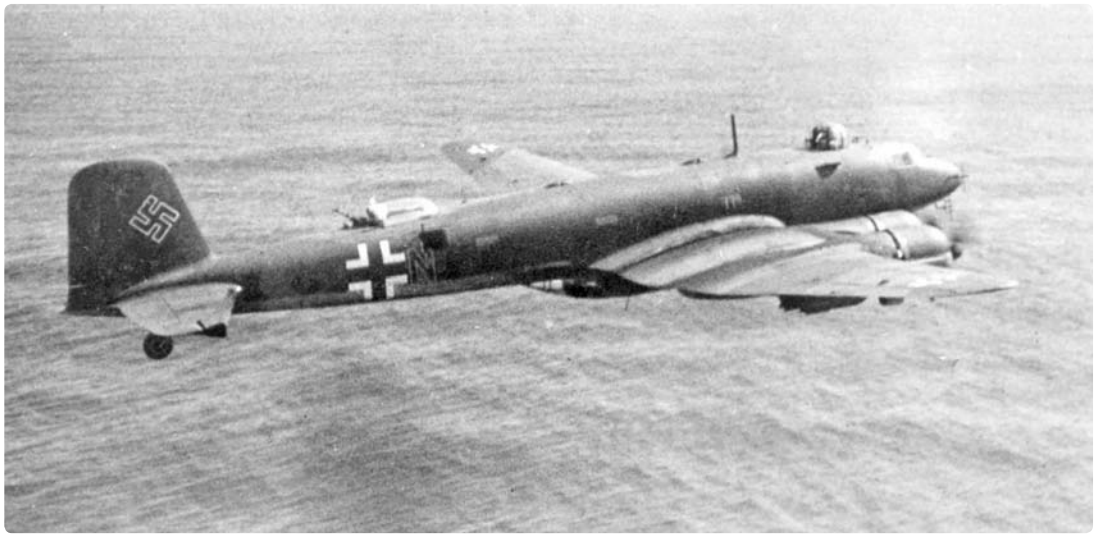
The end of March and start of April 1944 saw the last major combats between the Condors of KG 40 and Allied aircraft. On March 27 Allied convoy JW58/RA58 set sail with 49 ships, from Loch Ewe in Scotland to Murmansk in Russia. Within the massive escort were two carriers, *HMS Tracker* and *HMS Activity*, the former carrying the Grumman Wildcats of No 846 Sqn, and the latter the Wildcats of No 819 Sqn. The convoy was soon detected by the Luftwaffe, which began shadowing it and quickly began suffering losses. The first was a reconnaissance Ju 88D-1 of *1 Staffel (Fern)/Aufklärungsgruppe 22* — 1.(F)/22 — flown by Fw Walter Kolb, shot down by Lts Jack Large and Dick Yeo of No 819 Sqn. However, the position of the convoy had been radioed back to base and, at first light the following morning, Condors were detected in the vicinity. At 0725hr Sub-Lts Noel Simon and Alan Swift of No 819 Sqn got airborne in their Wildcats to intercept an unidentified aircraft. Simon relates what happened next:

"Take-off from the pitching deck was rather hair-raising, and then for the best part of two hours we were vectored all over the sky at heights ranging from sea-level to 10,000ft [3,000m] . . . the cloud was so extensive that although we must have been close to the bandit on more than one occasion, we saw nothing of it. Eventually, with petrol running low and feeling thoroughly frustrated, we were recalled.

"[As we were] approaching the convoy a little below the cloudbase, fighter control suddenly piped up urgently with a fresh course to steer. As I turned on to the new heading, I spotted the dull grey form of a Condor several miles ahead, flying very low and away from me. Dropping to sea-level, I opened up to full throttle, switched on the gunsight and cocked the guns.

"I flew as low as I dared, virtually skimming the wavetops. The Condor continued on a steady course but as we drew near, it started a gentle turn to port. By then the range was closing rapidly and I could not believe that we hadn't been spotted. We were approaching so fast that at the last moment I had to throttle right back to avoid overshooting.

"Leaving my No 2 to take the port side, I concentrated on the starboard, almost immediately opening fire from astern and



ABOVE ***The unit that used the Condor more than any other, KG 40 was formed at Bordeaux-Mérignac in July 1940, operating as part of*** **Fliegerführer Atlantik** ***(Atlantic Command). This Fw 200C-6, WNr 0214 of 9./KG 40, is coded F8+NT; F8 was KG 40's identification code, T represented 9 Staffel and the N was the aircraft's individual code.***

RIGHT ***Sub-Lieutenant Noel Simon was one of two pilots who intercepted a Fw 200 over the Svalbard archipelago while flying Grumman Wildcats with No 819 Sqn in March 1944. Simon later became a wildlife and conservation pioneer in Kenya.***

slightly below. I was so close, the Condor's slipstream caught my aircraft, the turbulence momentarily throwing me off aim, but by then I could hardly miss. I saw my bullets raking the two starboard engines, both of which began to smoke. As they caught fire, the Condor's nose dipped and, almost as though in slow motion, plunged into the sea in a shower of spray. I had to pull sharply away to avoid following it into the water."

The Condor crashed at 0920hr south of Bear Island in the Norwegian Svalbard archipelago. Some seven hours later another Condor fell victim to Sub-Lts Gordon Debney and Reg Meed of No 846 Sqn, the Condor breaking up and falling into the sea at 1627hr. However, the day did not end there, as *HMS Tracker's* diary reveals:

"1800hr; Lt G.B.C. Sangster and Sub-Lt H. Beeston flew off to intercept a bandit. At 1820hr they spotted an Fw 200. First its port outer engine was set on fire, then starboard inner and then again the port outer which had been extinguished. The enemy cartwheeled into the sea and smoke could be seen from the ship."

It had been a dreadful day for the Condors. Although it is not possible to say who got what, the Condors flown by Ofw Alfred Weyer, Oblt Alfred Klomp and Uffz Alfred Göbel were all shot down, with the deaths of 20 aircrew.

Although Condors were sighted in the days that followed, no more were engaged or lost. However, the following evening, a Blohm und Voss Bv 138C-1 of 3.(F)/130, captained by Oblt Kurt Kannengiesser, fell victim to the Wildcats of Sub-Lt George Willcocks of No 846 Sqn and Lt John Scott of No 819 Sqn. A Ju 88D-1 of 1.(F)/22, flown by Fw Oswald Herpel, was shot down by Lts George Sangster and Wilfred Vittle of No 819 Sqn at 1650hr on April 2, 1944.

The U-boats fared little better, three Wolfpacks each of four submarines, plus another five additional U-boats being sent to intercept the convoy. No ships were hit and the convoy got

LEFT ***The Condor could bite back if attacked, its defensive armament comprising one 7·9mm MG 15 machine-gun in the forward dorsal turret, one 13mm MG 131 in the rear dorsal turret, one 13mm MG 131 in each of the beam hatches (as seen here), one 20mm MG 151/20 cannon in the forward ventral position and one 7·9mm MG 15 in the aft ventral position.***

BELOW ***The Condor was regularly beefed-up during its service career; early Fw 200As, Bs and Cs were powered by 850 h.p. BMW 132 engines, replaced from the Fw 200C-3 onwards with 1,000 h.p. Bramo 323R Fafnirs.***

through unscathed, but four of the U-boats were lost. On March 29 *U-961* was sunk by *HMS Starling*; on April 1 *U-355* was damaged by a Grumman Avenger of No 846 Sqn and then sunk by *HMS Beagle*; on April 2 *U-360* was sunk by *HMS Keppel,* and finally, on April 3 *U-288* was sunk by a Fairey Swordfish of No 819 Sqn in concert with the Avengers of No 846 Sqn. A total of 202 U-boat crewmen and 34 Luftwaffe aircrew died in futile attacks on this convoy.

SITTING DUCKS

It was clear that the Condors could no longer keep operating the same way — especially when, on March 20, 1944, III./KG 40 reported that of its 35 aircraft on strength, only eight were serviceable (three months later this had changed to 23 on strength, but with 12 serviceable). On April 1, 1944, *Fliegerführer Atlantik* (Atlantic Command) was disbanded, with KG 40 and other associated units now coming under *X Fliegerkorps*. From this point, Condor losses on operations dropped to zero, but many aircraft and crews were still being lost in accidents or falling victim to intruding Allied aircraft.

May 1944 saw two Condors lost in accidents, with the deaths of eight crew, and another two destroyed in June 1944, the worst occurring on the 14th when, during a transport flight, Ofw Hans Hauenstein's Condor of 9./KG 40 hit a tree landing at Roth in Germany, killing ten air- and groundcrew and injuring another two.

The final Condor intruder victim in France occurred on July 5, 1944. Feldwebel Otto Kipp was an experienced radio operator with III./KG 40, his operational flying career having started in Heinkel He 111s in the summer of 1941. Kipp recalls the events of July 5:

"We were ordered to fly to an auxiliary airfield located at the so-called Charentes meadows [in west-central France], [where] the aircraft would be protected from the daily fighter-bomber attacks. We took off early in the morning, [having] been told there were no enemy aircraft in our airspace. However, this proved to be wrong and we were attacked by a [Lockheed P-38] Lightning just after take-off, at an altitude of 160ft [50m]. Our 'plane burst into flames, so we had to make an emergency landing in a cornfield where farmers were harvesting."

Condor F8+UL of 3./KG 40 banks over a typically Norwegian landscape in 1944. While the type enjoyed a period of great success in the early days of the Battle of the Atlantic, when British convoys sailed with little or no air defence, by the end of 1942 the Fw 200 had lost its advantage as an effective anti-shipping weapon owing to vast improvements in Allied shipping defences.

The Condor's attacker was Capt Art Jeffrey of the 434th Fighter Squadron (FS), 479th Fighter Group. Some 13 P-38s of the 434th FS arrived over Cognac just after 0900hr and immediately spotted the Condor taking off; the result was inevitable, as Jeffrey's combat report reveals:

"My right wingman called over the radio that a 'plane was taking off. Since my Flight was closest, I called *Newcross Leader* to furnish top cover while I went down for a pass. The 'plane had made a 180° turn to port and was staying on the deck, close to the aerodrome and town. There was quite a lot of flak being shot at us from this area. I came at the enemy aircraft from the front, making a 180° overhead pass and setting up for a stern shot at him.

"I began firing at about 350yd, closing to about 50yd, giving him about a 10sec burst. The right [starboard] inboard engine caught fire immediately and parts flew off it. The pilot then made a belly landing, and by the time the ship had stopped skidding, the whole 'plane was ablaze. I observed one man making his escape from the front of the ship."

Amazingly, half of the crew emerged from the rear of the burning Condor without injury; the three that were wounded, including Otto Kipp, had only light injuries. The mechanic, Uffz Otto Kiphut, was killed by a single bullet to the head.

A TACTICAL WITHDRAWAL

In the wake of the Allied invasion of Normandy on June 6, Condors were no longer able to operate from French bases. As a result, the following month the decision was made to withdraw them to Norway, Germany or Austria. They would henceforth be used only in the transport role, that for which they had originally been designed, as it was impossible to perform effective combat sorties with any guarantee of success — or even of getting back in one piece.

Losses continued. On July 9, 1944, Lt Helmut Kütterer of 7./KG 40, who had been shot down by American fighters on March 5, crashed into a mountain at Saint-Nicolas-des-Biefs, north-east of Clermont-Ferrand, while on a ferrying flight; 12 air- and groundcrew were killed.

Meanwhile, having moved to Norway, III./KG 40 was still trying to continue as an effective operational unit. On August 14, experienced pilot Oblt Rudolf Biberger was introducing a new crew from 8./KG 40 to the Trondheim area, only for the Condor to hit the ground during a turn, probably caught in a gust coming off a mountain. Six crew, including Biberger, were killed, and one was injured.

Despite all this doom and gloom, there was the occasional success for the Condor. Oberleutnant Karl-Heinz Stahnke was a highly experienced transport pilot who had transferred to 3./KG 40 in the spring of 1943. As well as performing normal Condor sorties, he was also tasked with reconnaissance and resupply missions to weather stations in the Polar Region.

One such weather station, *Schatzgräber* (Treasure Hunter), was located on Alexandra Land, the most westerly island of Franz Josef Land, and had been operating under the noses of the Soviets since September 1943. In early July 1944 it was discovered that nine of the ten-man detachment had fallen very ill as a result of eating polar-bear meat. Ice prevented seaplanes or boats from getting there, so on July 7 Stahnke took off from Banak in northern Norway. After an 8hr flight Stahnke landed on what appeared to be a suitable landing area, three miles from the weather station.

The inner tyre of the starboard mainwheel unit and the tailwheel were damaged during the landing, and the Condor ran into a dip, tipping on to its nose and back again, after which it sank up to its axles in melting ice. Nevertheless, a

TAH ARCHIVE

ABOVE ***Bristol Beaufighter VI KV912 was one of more than 100 radar-equipped examples supplied to the USAAF for nightfighting duties in the European theatre of operations. It was one of these machines, operating with the 415th Night Fighter Squadron, that dispatched Fw 200D-2 D-AMHL, named*** **Pommern,** ***on September 27, 1944.***

party from the aircraft, including a doctor, made it to the weather station and began treating the sick crew.

Stahnke had now to get home again. On July 8, a Blohm und Voss Bv 222 flying-boat dropped aircraft spares, and over the next two days the crew repaired the Condor and created an obstacle-free strip on the ice. Finally, on the evening of July 10, after a hair-raising take-off, the Condor plus passengers set course for Banak, landing there without incident the next morning. Stahnke was subsequently awarded the *Ritterkreuz* on October 24, 1944.

Such successes were the exception to the rule, however. The last Condor to be shot down was lost at the end of September 1944. *Flugkapitän* Helmut Liman was a pre-war Deutsche Luft Hansa (DLH) pilot who flew operationally with 7./KG 40, but had transferred back to DLH. On September 27 Liman was at the controls for a passenger flight from Stuttgart to Spain in a Fw 200D-2. At 2031hr the Condor was intercepted by a Bristol Beaufighter of the USAAF's Corsica-based 415th Night Fighter Squadron, crewed by Capt Harold Augspurger and 2nd Lt Austin Petry, who shot down the Fw 200, which crashed at Saint-Nicolas-lès-Cîteaux, south of Dijon. The crew of three plus five passengers were all killed.

CLOSE TO EXTINCTION

For the remaining six-and-a-half months of the war the Fw 200 was all but extinct. Condors were now solely performing transport tasks, but even then losses occurred. One particularly tragic loss happened on October 11, when a Condor of 7./KG 40, flown by Lt Hans Gilbert, crashed south of Bardufoss in northern Norway. The cause was structural failure owing to the aircraft being overloaded; the Condor was carrying five crew and 46 passengers, 41 of which were German female auxiliaries. There were no survivors.

On October 21 a Condor being flown by Ofw Wolfgang Liepe of 7./KG 40 crashed on take-off from Nautsi on the Norwegian/Finnish/Russian border while on a transport flight. Three crew, including Liepe, were killed and three injured.

November 1944 would finally see KG 40 disbanded — in over-optimistic preparation for the formation of the Messerschmitt Me 262-equipped KG (Jagd) 40 — and its aircraft and personnel dispersed to other units or grounded. Condor unit 8./KG 40 became *Transportfliegerstaffel Condor* and was commanded by Hptm Ludwig Progner, formerly of 7./KG 40. Some aircraft were transferred to *14./Transportgeschwader 4* at Wiener-Neustadt in Austria, where two Condors formed a *Sonderkommando* (Special Unit) commanded by Oblt Karl-Heinz Stahnke, the other pilot being Ofw Adalbert Schraffanek. This unit's main claim to fame is that it was involved in the last recorded RAF combat with a Condor, albeit with the latter on the ground and the results of which were inconclusive.

The RAF had become aware of regular transport flights by Condors between Wiener-Neustadt or Horsching in Austria and Calato airfield on Rhodes in Greece. The precise purpose of these sorties (the first being recorded by the Allies on January 28, 1945) was unknown, but it was thought that they were probably part of preparations for an attack on the Suez Canal with Henschel Hs 293 anti-shipping remotely-guided missiles.

At 2345hr on March 30, 1945, Stahnke, who had been awarded the *Eichenlaub* (Oak Leaves) to his Ritterkreuz three days before, took off from Wiener-Neustadt, arriving at Calato just before dawn on March 31. The Condor, together with an He 111 and a Junkers Ju 52/3m, was spotted

LEFT *In an attempt to increase the Condor's waning offensive capability, the type was modified to carry a single Henschel HS 293 guided bomb beneath each of the outer engine nacelles. This Fw 200C-8, WNr 0256, has been converted into a Fw 200C-5/FK for Hs 293 operations. The* **Hohentwiel** *antenna array on the nose is clearly visible, as is the cabin heating system air inlet on the underside of the aircraft's large offset-to-starboard ventral gondola.*

BELOW *Peekaboo! In this dramatic still from gun-camera footage taken by one of the Beaufighters of No 252 Sqn during the raid on Calato airfield on Rhodes on March 31, 1945, Karl-Heinz Stahnke's Condor is visible between the trees rather primitively camouflaged with a few tarpaulins and some tree branches. Amazingly, the Beaufighter pilots failed to see the Condor, which was coded G6+AY of 14./Transport-geschwader 4.*

ABOVE ***Oberleutnant Karl-Heinz Stahnke (third from right) and his crew at Værnes in April 1944. Stahnke joined 3./KG 40 in the spring of 1943 and went on to become one of the most experienced Fw 200 pilots of the war, participating in numerous Condor operations, including perilous resupply flights to weather stations in the Arctic.***

on the ground by an Allied photo-reconnaissance aircraft. As a result, six Beaufighters of No 252 Sqn, based at Hassani in Greece and led by Sqn Ldr Tony Hunter, lifted off at 1450hr the same day with the intent of destroying the German aircraft at Calato.

This was not the first time No 252 Sqn had been after a Condor on Rhodes. On March 17 Fg Off Doug Reid DFM and Fg Off Ron Ray DFM undertook a recce sortie to locate Stahnke's Condor, which had arrived two days before. They saw nothing, suggesting that the Condor must have been well camouflaged, as it took off for Austria the following day.

On arriving at Calato, the Beaufighter crews saw nothing, so promptly attacked buildings on the airfield with their cannon, experiencing moderate to heavy flak in return, which damaged Fg Off J.K. Underwood's Beaufighter in the tail, the nose of Flt Sgt L.G. Armitage's aircraft and the undercarriage of Fg Off Bill Escreet's mount. All six landed back at base safely, the gun-camera film taken by Reid revealing, to everyone's great annoyance, the Condor cleverly camouflaged among a grove of olive trees. Stahnke took off that evening.

As a postscript, at the end of the war the Allies discovered Condor G6+FY, together with Schaffranek and his crew, at Calato, where the latter had arrived on May 3, 1945.

The last recorded wartime Condor flights occurred on May 8, 1945. An Fw 200 of Transportfliegerstaffel Condor, flown by Ofw Willi Bergen, took off from Værnes, near Trondheim, then diverted from its intended destination of Kurland, near Oslo, to Achmer in Germany. On the same day, Uffz Harald Loseke from the same unit landed his Condor at Torslanda in Sweden with six crew/passengers from Transportfliegerstaffel Condor and reconnaissance unit 1(F)./22. Although the aircraft was later seen in RAF markings, it was, like all Condors found languishing on airfields around Europe, later scrapped.

Photographed at Torslanda, near Gothenburg in Sweden, by British aviation journalist John Stroud during a Scandinavian tour in the summer of 1946, Fw 200C-3/U1 WNr 0191, F8+MS (later G6+ST), has had its German markings painted over. Despite being in what appears to be remarkably good condition, it was scrapped in 1948.

Não obrigado!

Portugal's flirtation with the Hunting Jet Provost & BAC Strikemaster

With the help of a collection of contemporary colour photographs, Portuguese aviation historian **JOSÉ MATOS** relates how Portugal said "no thanks" when offered the Jet Provost as a trainer in 1959, but was told "thanks, but no" when trying to acquire the type's beefier ground-attack sibling, the Strikemaster, only a decade later

ALL IMAGES GEN CONCEIÇAO E SILVA UNLESS OTHERWISE STATED

BY THE LATE 1950s the *Força Aérea Portuguesa* (FAP — Portuguese Air Force) was in need of a replacement for its ageing collection of North American T-6 advanced trainers. What was required was a modern aircraft with which to train Portugal's new generation of fast-jet pilots. To this end the FAP tested the prototype of the French-designed Morane-Saulnier MS.760 Paris jet trainer in May 1958 — but, during a landing at Sintra Air Base, the aircraft, F-BGVO, left the runway and caught fire, with the French test pilot and a Portuguese student pilot suffering from severe burns.

Next on the FAP's list was Britain's Hunting Jet Provost, the prototype of which had made its maiden flight in June 1954. Accordingly, in October 1959 the Jet Provost T.2 company demonstrator, G-AOUS, was sent to Portugal to be flight-tested at Sintra, home of the FAP's military academy and flying school. The aircraft received the provisional Portuguese serial "5803", following in sequence the serials assigned to the two de Havilland Vampire T.55s acquired by the FAP in 1952.

The Jet Provost, the sole T.2B, fitted with the 2,500lb-thrust Armstrong Siddeley Viper 11 turbojet later used for the T.4 variant, was tested by *Capitão* Belo, an instructor at the military academy, and by *Tenente* (Lieutenant) Conceição e Silva and *Alferes* (2nd Lt) Braga Gonçalves, both of whom were students. The aircraft was not fitted with ejection seats, these being incorporated only from the T.3 variant onwards. While in Portugal, the British jet suffered a minor accident when Gonçalves left it rather late when lowering the undercarriage, resulting in a belly landing at Sintra. The trainer was recovered and quickly repaired at the base.

Although the results of the evaluation of the Jet Provost had been broadly positive, the FAP ultimately selected the Cessna T-37C to fulfil its requirement, no doubt influenced by the favourable terms under which the aircraft were supplied as part of the USA's Mutual Defense Assistance Program (MDAP).

Another crack at the export prize

With the beginning of Portugal's colonial war in Africa in 1961, the FAP swiftly realised its need to replace its obsolete fleet of Lockheed PV-2 Harpoons and T-6Gs then on the front line

OPPOSITE PAGE, TOP ***The sole Jet Provost T.2B, G-AOUS, was put into*** **Força Aérea Portuguesa** ***(FAP) national insignia and training bands and flown to Portugal for trials in October 1959.*** **OPPOSITE PAGE, BOTTOM** ***The aircraft was given the FAP serial "5803". Artwork by PAULO ALEGRIA © 2017.*** **THIS PAGE, TOP** ***The three FAP pilots tasked with testing the Jet Provost, from left: Lt Conceição e Silva, Capt Belo and 2nd Lt Braga Gonçalves.***

ABOVE ***The T.2 incorporated a number of significant modifications to the T.1, including the replacement of the latter's spindly long-stroke undercarriage with much shorter hydraulically-operated units . . .***

LEFT ***. . . and a more powerful engine, the Bristol Siddeley Viper 8 was fitted, although the sole T.2B, G-AOUS, which became "5308" during the FAP's trials, had a Viper 11 installed, as declared on the aircraft's nose.***

BELOW ***Oops! There were red faces all round for the aircraft's pilots when it came to rest on the grass beside the runway at Sintra after the lowering of the undercarriage was left too late during a test-flight landing. Fortunately, the damage was minimal and quickly repaired.***

A mobile crane removes the Jet Provost from the grass at Sintra after its mishap. Only four T.2s were built, G-AOUS later coming to grief when it crashed near Biggleswade during diving trials, killing Hunting test pilot Lt-Cdr J.R.S. Overbury, on November 16, 1960.

of its African operations. The PV-2, a Second World War-vintage maritime patrol aircraft, was capable of performing ground-attack duties, but was woefully lacking in speed and manœuvrability. Similarly, the T-6 was a pre-war trainer adapted for the light ground-support role which could offer only minimal weapons capability and poor manœuvrability; furthermore, its low cruising speed made it extremely vulnerable to anti-aircraft fire.

Acutely aware of this operational shortfall, the FAP instigated a major rearmament study in the late 1960s, the results of which pointed to the USA's North American OV-10A Bronco as the best option for light attack missions, followed by Cessna's A-37 Dragonfly (an armed variant of the FAP's T-37C). The UK's BAC 167 Strikemaster (a similar development of the Jet Provost) and Italy's Aermacchi MB-326G were also considered. However, the USA had made it clear it would not do anything that would appear to support Portugal's colonial war, thus precluding the purchase of the FAP's two most favoured options, leaving only the English and Italian types, with the British jet leading the Italian contender in the study's ranking.

The FAP thus had little choice but to evaluate the Strikemaster, sending Capt Vizela Cardoso of the FAP's Fighter Training Squadron at Ota to London in 1970 to undertake a preliminary assessment of the aircraft during that year's SBAC show at Farnborough in September.

On September 10 Cardoso strapped into Strikemaster G-AYHS, which also bore serial "314" of the Singapore Air Defence Command (SADC), to which the aircraft was due to be delivered, for a demonstration flight. While another Strikemaster, G-AYHT (SADC 315), was displayed in the static park accompanied by its impressive weapons load, G-AYHS/314 was used by the manufacturer for the type's display at the show as well as demonstration flights for

ABOVE *Trials pilots Belo (right-hand seat) and Gonçalves in the cockpit of the Jet Provost at Sintra during its FAP tests. The air arm ultimately chose the Cessna T-37C which, perhaps significantly, incorporated wing hardpoints which could carry ground-attack stores. The Jet Provost was strictly a trainer until the development of the BAC Strikemaster.*

pilots of interested nations. Cardoso evidently enjoyed flying the Strikemaster and, on his return to Portugal, conveyed his favourable impression to the General Staff of the Air Force.

The Strikemaster was equipped with the more powerful Viper 535 engine and strengthened to incorporate two hardpoints on each wing for air-to-ground ordnance and/or long-range tanks; two internally-mounted standard Nato 7·62mm machine-guns could also be fitted. With orders from Saudi Arabia, Singapore, Kuwait and the Sultanate of Oman, the Strikemaster clearly represented a great advance on Portugal's ageing fleet of T-6Gs in Africa.

Following Cardoso's endorsement of the type, an FAP delegation led by *Teniente Coronel* (Lt-Col) Costa Gomes was sent to the BAC factory at Preston, Lancashire, in December 1970 for an operational assessment of the aircraft.

RICHARD T. RIDING

ABOVE ***The SBAC show at Farnborough in 1970 provided the FAP with an opportunity to test-fly the Jet Provost's ground-attack descendant, the BAC Strikemaster, a pair of which was displayed at the show in the colours of the Singapore Air Defence Command. Portuguese pilot Capt Cardoso test-flew G-AYHS/"314", furthest from camera.***

After flying a Strikemaster (with B Conditions marking G-27-191) Gomes and his team also reported favourably on the type, prompting the Portuguese authorities to begin negotiations with BAC about acquiring the type for the FAP.

All was far from plain sailing, however. The Portuguese had not reckoned with the intervention of British Prime Minister Edward Heath and his Conservative government, which refused to authorise the sale of the aircraft owing to resolutions passed in 1963 by the United Nations (UN) Security Council. These resolutions called for all member states not to provide Portugal with any military equipment that may be destined for use in the colonial war in Africa, despite the UK opting to abstain from the UN voting process on this particular issue.

Third time lucky?

Although the road seemed blocked, the Portuguese did not give up and made a renewed bid to acquire the Jet Provost in 1973. The initial plan called for the purchase of between 20 and 114 examples of the trainer in a potential £40m deal, a tempting offer which led to a fevered exchange of correspondence between various departments in Whitehall in order to clarify the policy line that should be followed in this case.

It was ultimately the Foreign & Commonwealth Office (FCO) which defined the potential deal's main trouble spots. In a memorandum dated January 11, 1973, FCO diplomat Alan Brooke Turner pointed out that there would be clear benefits to the British aircraft industry should the deal go ahead. However, he explained, the British government would be unwise to violate the 1963 UN resolutions, and urged great caution in negotiating with the Portuguese. Although the Jet Provost was a training aircraft, Brooke Turner expressed concern that it would not be difficult to adapt the type for combat in Africa, as the Portuguese had done with the T-6G. In this context, the sale could only be authorised if the Portuguese were willing to give formal iron-clad assurance that the aircraft would only be used within the scope of Nato operations or purely for fulfilling training requirements in Portugal. It was a commitment that Brooke Turner thought that the Portuguese would have difficulty accepting.

It was the FAP which ultimately lost interest when it was realised that a similar — indeed, superior — type, the Dassault Alpha Jet, could be acquired from the French without any such restrictions and undertakings. In June 1973 a delegation led by the FAP Chief of staff, Gen Tello Polleri, visited the French company at the Paris Air Show, thus beginning the process which would lead to Portugal's acquisition of 50 of the ground-attack Alpha Jet A variant and the final abandonment of the Jet Provost and its ground-attack stablemate.

ARTWORK BY IAN BOTT © 2017

Fire in the BELLY

In 1939, after nearly a decade of official indifference, work was finally proceeding on the radical new powerplant developed by Frank Whittle and his colleagues at Power Jets. With the concept rapidly evolving into a flyable test unit, it was suggested that the new engine be test-flown in a modified existing airframe, rather than wait for the bespoke Gloster E.28/39. Enter the jet-powered Anson, as **NICK STROUD** explains

BY THE END of 1939, after nearly a decade of struggling to convince the British Air Ministry of the virtues of his innovative concept to employ gas-turbine technology to create jet propulsion for a new type of aircraft powerplant, Sqn Ldr Frank Whittle was finally on the road to seeing his efforts bear fruit — in the form of an airframe designed and built specifically to incorporate his nascent centrifugal-flow turbojet engine. After a great deal of work by Whittle and his team at Power Jets Ltd, the company he had formed in partnership with two former RAF officers and an investment bank in March 1936, the Air Ministry finally began to regard the project as the basis of a practicable propulsion unit. Accordingly, in July 1939 the Ministry awarded a contract to Power Jets for a flight engine and began discussions with the Gloster Aircraft Co regarding the design and construction of an experimental airframe in which to fly it.

Ten years later Gloster's chief designer, W.G. Carter, recalled his impressions on seeing the engine for the first time in September 1939:

"After some preliminary talk [Whittle and I] went along to the test bay, and I had my first sight of a gas-turbine-cum-jet-propulsion unit. It seemed to me to be a quaint sort of contraption — rather on the rough-and-ready side — and by no means the kind of thing to inspire confidence as a prospective power installation.

"It started working with a characteristic muffled thud as the fuel mixture was ignited and was quickly speeded up to register a modest amount of thrust, which to the best of my recollection was about 400lb. Some parts of the engine casing showed a dull red heat which, combined with an intensely high-pitched volume of noise, made it seem as though the engine might at any moment disintegrate into bits and pieces."

With work proceeding on the first flight engine, designated W.1, a contract was placed with Gloster on February 13, 1940, for a "single-engined single-seat aeroplane for research work in connection with the Whittle engine". Its primary purpose would be to flight-test the powerplant, but it would also "be based on requirements for a fixed-gun interceptor fighter as far as the limitations of size and weight imposed by the power unit permit".

Keen to start flight trials of the new engine as soon as possible, and with the first flight of Gloster's airframe to Specification E.28/39 at least a year away, Power Jets initiated discussions with the Air Ministry about the possibility of earlier trials using a modified existing aircraft. A letter (covered briefly in Air-Britain's Autumn 2016 issue of *Aviation World*) from one of Power Jets' Directors, Scottish financier and industrial engineer Lancelot Law Whyte, dated December 8, 1939 (TNA ref AVIA15/211), addressed to Capt R.H. Liptrot, Assistant Director (Technical Investigation) at the Air Ministry, reviews a discussion between the two held a few days previously. Its subject was a proposal for "additional accelerated flight tests" for the new powerplant. In the letter, Whyte states:

"Squadron Leader Whittle and I have now given careful consideration to this proposal and we regard it as one of considerable importance. The advantage gained in time and safety appear to us to be out of all proportion to the relatively small cost and trouble involved."

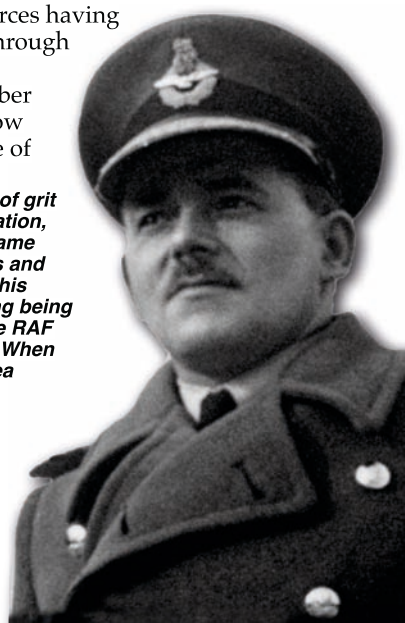
Enclosed with the letter were three copies of a memorandum, "amplifying the rough note which Sqn Ldr Whittle left with you last week".

FINDING A SUITABLE AIRFRAME

The memorandum, written by Whyte, put the case for a series of flight trials to be conducted while the design and construction of the Gloster airframe was ongoing, in order to investigate some of the new powerplant's more general characteristics — it was after all brand-new untried technology. Whyte begins his proposal as follows:

"During July [1939], when the question of flight tests was first under serious discussion, it was suggested that it might be possible to test the Whittle engine in an existing aeroplane modified for this purpose. It was realised that this would not provide a proper test of the performance of the engine, but that experience of the behaviour of the engine in flight might thus be gained more rapidly than by any other method."

With German forces having rolled their way through large swathes of Europe by December 1939, there was now very much a sense of



The personification of grit and sheer determination, Frank Whittle overcame numerous obstacles and disappointments in his early years, including being rejected twice by the RAF on fitness grounds. When he submitted his idea for a new type of gas-turbine engine to A.A. Griffith at the RAE in 1929, it was dismissed as "impracticable".

PHILIP JARRETT COLLECTION

ABOVE ***One of the aircraft considered for the fitting of a Whittle jet powerplant was the General Aircraft Ltd Cygnet II two-seat light tourer, powered by a 150 h.p. Blackburn Cirrus Major and fitted with an unusual tricycle undercarriage. This example, G-AGBN, was impressed into RAF service in July 1941 and given the serial ES915.***

urgency when it came to developing technology which could provide any advantage for Britain, which was looking increasingly vulnerable as Germany speared westwards across the Continent. Whyte relates why the initial flight test proposal was rejected in the summer — "the programme now being followed was regarded as a better alternative" — but goes on to suggest that the outbreak of war has applied additional impetus to move the project along as quickly as possible:

"That decision was made before the war began and the purpose of this note is to re-open the consideration of this method of obtaining an earlier flight test, not as an alternative to the present plan, but as a supplement to it."

The idea, as outlined by Whyte, was to build a "light low-speed aeroplane . . . built of existing components to carry a single Whittle engine of W.1 type as its sole power unit". The aircraft would essentially be a type that already existed, but modified to carry the new powerplant; it would "not be expected to operate outside its normal range of speed and height".

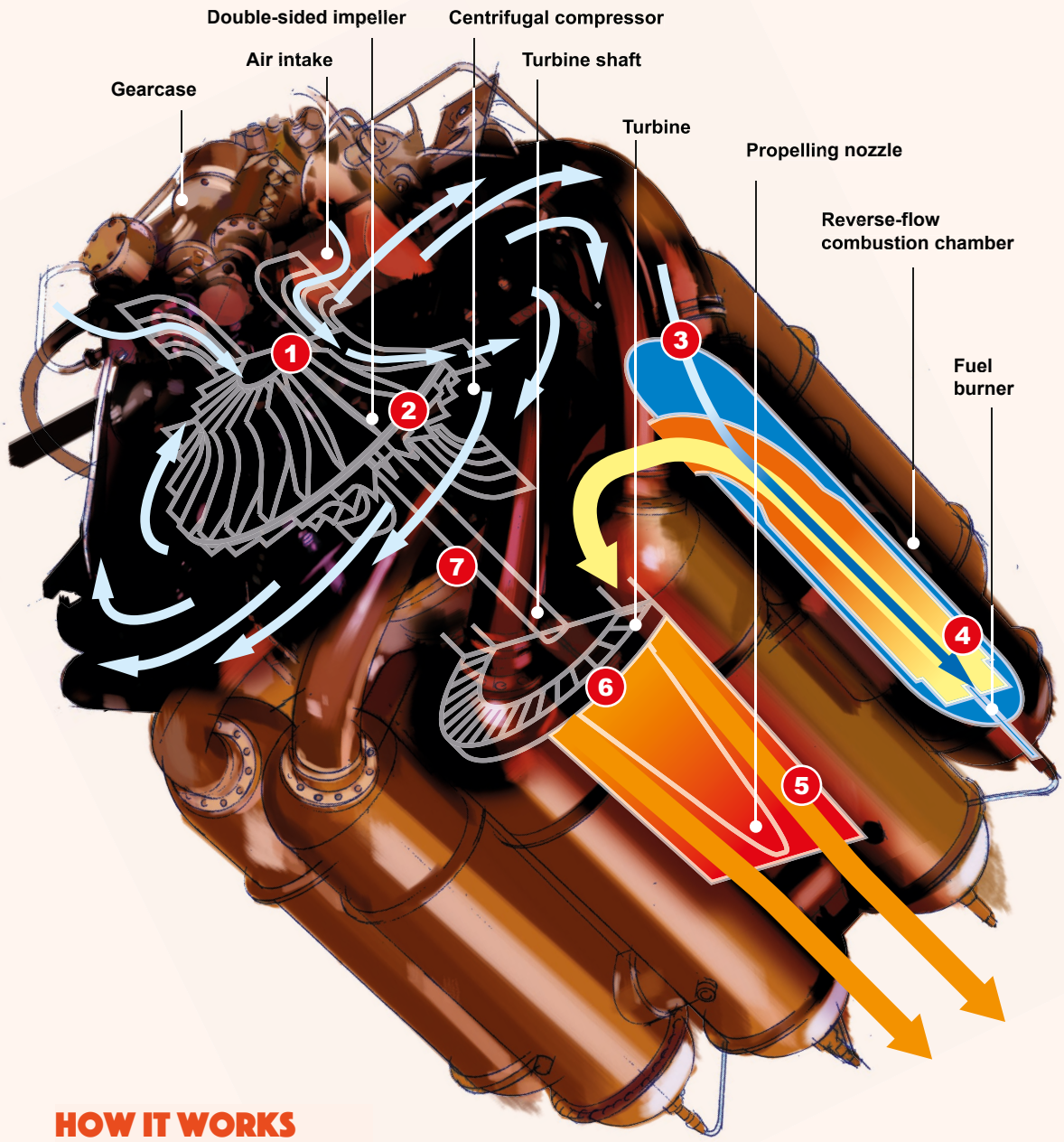
Whyte anticipated that such a "relatively crude modification" could be completed in as little as three months "at the cost of, say, £2,000 including the cost of the aircraft". As an example, Whyte suggested that the wings, tail unit and tricycle undercarriage of a General Aircraft Ltd (GAL) Cygnet II might be used in conjunction with a fuselage constructed of wood, welded-tube and fabric; it would certainly be cheap to build, but perhaps not of the best materials to flight-test an engine that had glowed red-hot during bench-tests. "Alternatively the wings and tail unit of some other light aeroplane might be used with the Cygnet undercarriage," Whyte added. Presumably a tricycle undercarriage was preferable as it was unknown what effect a downward-facing jet efflux from a taildragger may have on the grass or tarmac runway.

Whyte went on to explain that "lighter parts are now being substituted in the existing [engine] unit, which might be available for installation in about four months' time. It is therefore reasonable to expect that a preliminary flight test might be possible in four to six months after the sanctioning of the scheme".

The purpose of the tests would be to investigate various characteristics of the engine, including starting up, taxying and flight at low speeds and altitudes, knowledge of which would be useful before the first flight of the E.28/39. As Whyte explained, "these trials would be done with a view to discovering whether the Whittle engine behaved normally in an airframe when in motion at such speeds, or whether it showed any unusual properties", none of which was known to any great extent at the time. The chief advantage of pursuing this accelerated flight-test programme would be, in Whyte's words, "to reveal some of the difficulties which still have to be met up to six months earlier than might otherwise be the case".

Listed in the letter were a number of objectives for prospective investigation which would be of special interest, including the following:

THE WHITTLE W.1 CENTRIFUGAL-FLOW JET ENGINE



HOW IT WORKS

1. Air is drawn into the intakes on either side of the compressor
2. The impeller's centrifugal forces compress the air
3. The air exits the compressor and is fed to one of the ten combustion chambers
4. In the chambers fuel is mixed with the air and burnt
5. The rapidly-heated and expanded air exits the nozzle towards the rear of the aircraft. It is the reaction to this rearward flow of gases that creates the thrust to propel the aircraft
6. Some of the exhaust's energy is used to drive a turbine…
7. … which, in turn drives the compressor via the turbine shaft

Graphic: Ian Bott *www.ianbottillustration.co.uk*

PHILIP JARRETT COLLECTION

ABOVE ***Stearman-Hammond Y-1 PH-APY had been acquired by KLM as a tricycle undercarriage trainer for its prospective fleet of Douglas DC-5s, but was sold to the British Air Ministry and used by the RAE from the summer of 1939 with the military serial R2676. Fitting the Whittle W.1 unit would have presented something of a challenge!***

- the overload of bearings during turns;
- the behaviour of the governor;
- the effect of the jet and its efflux on adjacent control surfaces;
- the fuel system, engine controls etc;
- a technique of starting the engine up;
- general matters arising out of the combination of the Whittle engine plus airframe.

Whyte pointed out that maximum efficiency of the modified airframe would not be a consideration, so its design could be relatively straightforward. He posited that GAL at Hanworth, to the west of London, "has personnel available for this at the present moment and the above scheme would be put into effect without distracting Power Jets staff from their main programme". Whyte also states that the advantages bestowed by the project — a preliminary flight test up to six months earlier than would otherwise be possible — justified Whittle giving "a small part of his time to this working out of the details of this proposal".

Signing off his letter with an estimate that the cost of the project, including the installation of the engine in the modified airframe, "would almost certainly be less than £3,000", and restating his view that "an important advantage of this scheme is that the first flight test would be made under much safer conditions than those at present contemplated", Whyte awaited a response from the Air Ministry.

ALTERNATIVE PLANS

The idea was circulated among various establishments, and the paper trail picks up again with a letter from Dr G.P. Douglas at the Royal Aircraft Establishment (RAE) at Farnborough, to H.F. Vessey at Department ZA of the Air Ministry in Harrogate, dated January 13, 1940. Various ideas regarding what type of aircraft to modify had obviously been percolating, with a front runner being the unusual single-engined twin-boom Stearman-Hammond Y-1, a single ex-KLM example of which, PH-APY, had been delivered to the RAE in the summer of 1939 for tricycle undercarriage tests. Douglas's letter takes a view on the idea, and suggests an alternative:

"You asked us to consider the possibility of fitting a Whittle unit in an actual aeroplane so that flight tests could be made quickly and suggested the Stearman-Hammond. The big diameter — 60in [1·5m] — of the Whittle unit makes it difficult to fit to any small aeroplane . . . [others] are suggesting the simplest scheme would be to put it in an [Avro] Anson as an additional power unit."

Douglas added that there would be plenty of room in the fuselage of the latter type and that installation would be quick and easy.

A follow-up letter from Douglas to the Under-Secretary of State at the Air Ministry three days later continued the theme of fitting the Whittle engine into an existing airframe with the minimum amount of effort and financial resources expended. "We have looked into the question of installing the Whittle unit into an existing aeroplane for test purposes", Douglas explained. "If this is done without an extended experimental investigation we think it desirable that the aeroplane should be capable of flight independent of the Whittle unit, and should have a power comparable with the power developed by the Whittle unit". It was an

PHILIP JARRETT COLLECTION

ABOVE ***Miles Aircraft's first venture into twin-engined aircraft (and its first to have a retractable undercarriage), the M.8 Peregrine made its first flight on September 12, 1936. After a great deal of demonstration flying, it was dismantled in 1937, as Miles's capacity was taken up with building Magisters for the RAF. Only two M.8s were built.***

eminently sensible suggestion, particularly in view of the fact that there was as yet no concrete evidence about exactly how the new powerplant would behave once aloft in any airframe. Installing the unit into an aircraft which could get itself out of trouble by means of its own power should a problem arise was both prudent and achievable with minimal effort.

Douglas continued: "The Stearman-Hammond, suggested by you as a possibility, is not very suitable, because it would mean removing the main engine, and the jet would then impinge on the tail". There were some alternatives, however, as Douglas related: "There are two other aeroplanes that might possibly be used, namely the Miles [M.8] Peregrine or an Anson. The first of these is not a very good aeroplane, and if the tests are decided upon, we would much prefer to do them on an Anson".

THE JET ANSON

Douglas speculated that the Whittle engine would be relatively simple to install in an Anson, and could be fed its air supply by means of ducting from an intake in the nose through the fuselage. The turbine unit would be located close to the centre of gravity within the Anson's fuselage, the necessary inlet ducting curving to starboard from the nose to avoid the pilot's controls on the port side of the cockpit. The exit duct would be bifurcated close to the rear of the turbine unit, and the two exhausts would exit on either side of the fuselage, either at the bottom of the fuselage or two-thirds up the fuselage, in line with the cockpit. A fuel tank for the turbine unit would be located in the forward fuselage, aft of the cockpit but forward of the jet engine.

Douglas estimated that with the Anson flying at 10,000ft (3,000m), with its two Armstrong Siddeley Cheetah piston engines shut down and the Whittle unit running, the aircraft would have a true airspeed of about 150 m.p.h. (240km/h). As he explains in his letter: "The Anson would be able to take off with the turbine installed, by using its normal powerplant[s], and its safety will not depend on the satisfactory functioning of the turbine".

Appended to Douglas's letter to the Under-Secretary of State was a list of data which it was hoped might be attained if the plan proceeded. In terms of the turbine unit's behaviour, it was thought that this accelerated flight-test programme could pick up on any mechanical faults which may develop in flight — "e.g. failures due to gyroscopic couples introduced by interaction between rotor speed and aircraft rate of turn etc" — as well as give a good idea of the way the unit would function when complete with the necessary ducting — "e.g. examination of surging (if any), examination of temperature distributions, effect of rotation left in the gases forming the jet on the airframe". It was also hoped that the programme would help with the development of the method of controlling the turbine when fitted in an aircraft.

There would be benefits in investigating some of the aerodynamic aspects of the new powerplant too, including measuring the thrust developed by a "hot high-speed jet", checking the pressure effects introduced on the control surfaces by the presence of the jet, and studying the effects of the powerplant on stability, including moments introduced by yaw.

A somewhat basic blueprint for the installation

TAH ARCHIVE

ABOVE ***Known affectionately by its crews as "Faithful Annie", the Avro Anson entered RAF service in March 1936 as a general reconnaissance aircraft for Coastal Command. This Anson I, K6152, was delivered to the RAE at Farnborough from the manufacturer, so may have been a candidate for the fitting of the Whittle test unit in 1939.***

of the Whittle unit in an Anson was drawn up and circulated, but at this point the paper trail ends. We know that no such accelerated flight test programme for the Whittle engine was undertaken, so presumably the Air Ministry felt that work was proceeding satisfactorily on the E.28/39, and that it was prepared to await its completion in order to test the radical new means of motive power in flight. Indeed, so confident did the Air Ministry appear to be in the new concept that in November 1940 it issued Specification F.9/40 for a twin-jet fighter, despite the E.28/39 still being some six months away from its first flight.

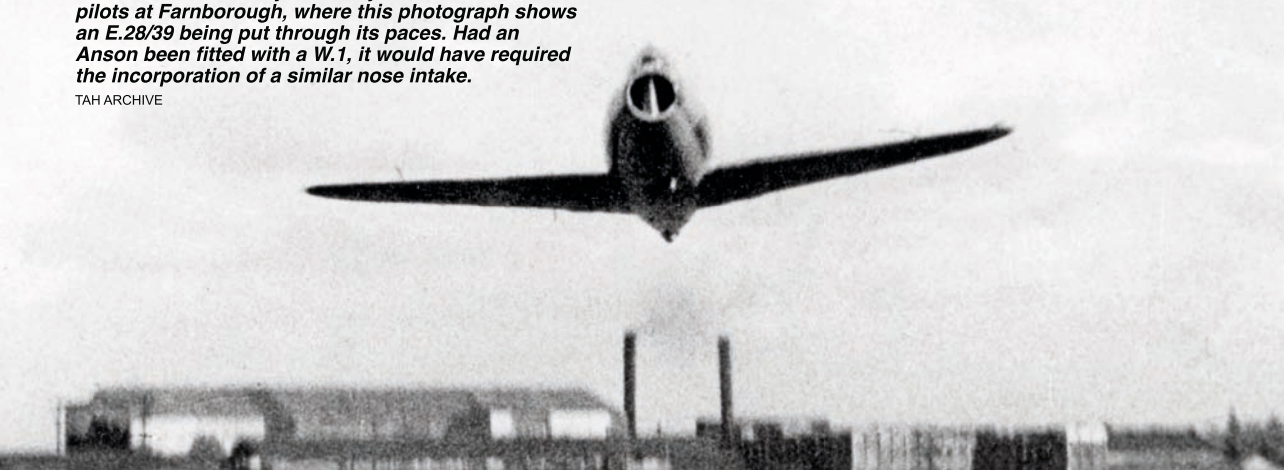
Given that no flight data for the W.1 was available and that it was being tested in a brand-new unflown prototype, it must have been with some trepidation that Gloster test pilot P.E.G. Sayer climbed into the cockpit of the diminutive E.28/39 at Cranwell on the evening of May 15, 1941, with the purpose of taking the aircraft on its maiden flight. With the canopy open, Sayer taxied the E.28/39 to the runway, where he pointed the machine into the westerly wind and ran the whining engine up to 16,500 r.p.m. With the brakes released, speed built up, the new method of propulsion requiring no fancy footwork on the rudder pedals from the pilot.

Raising the undercarriage at 1,000ft (300m), Sayer found the engine "quite smooth", as he reported on landing after his 17min flight. The engine had behaved well, and, much to everybody's relief, revealed no nasty surprises. The confidence of all involved in the project had been repaid in spades, without the need for a jet-powered Anson — a pity perhaps; Faithful Annie with a flamethrower under her petticoat would have been something to behold!

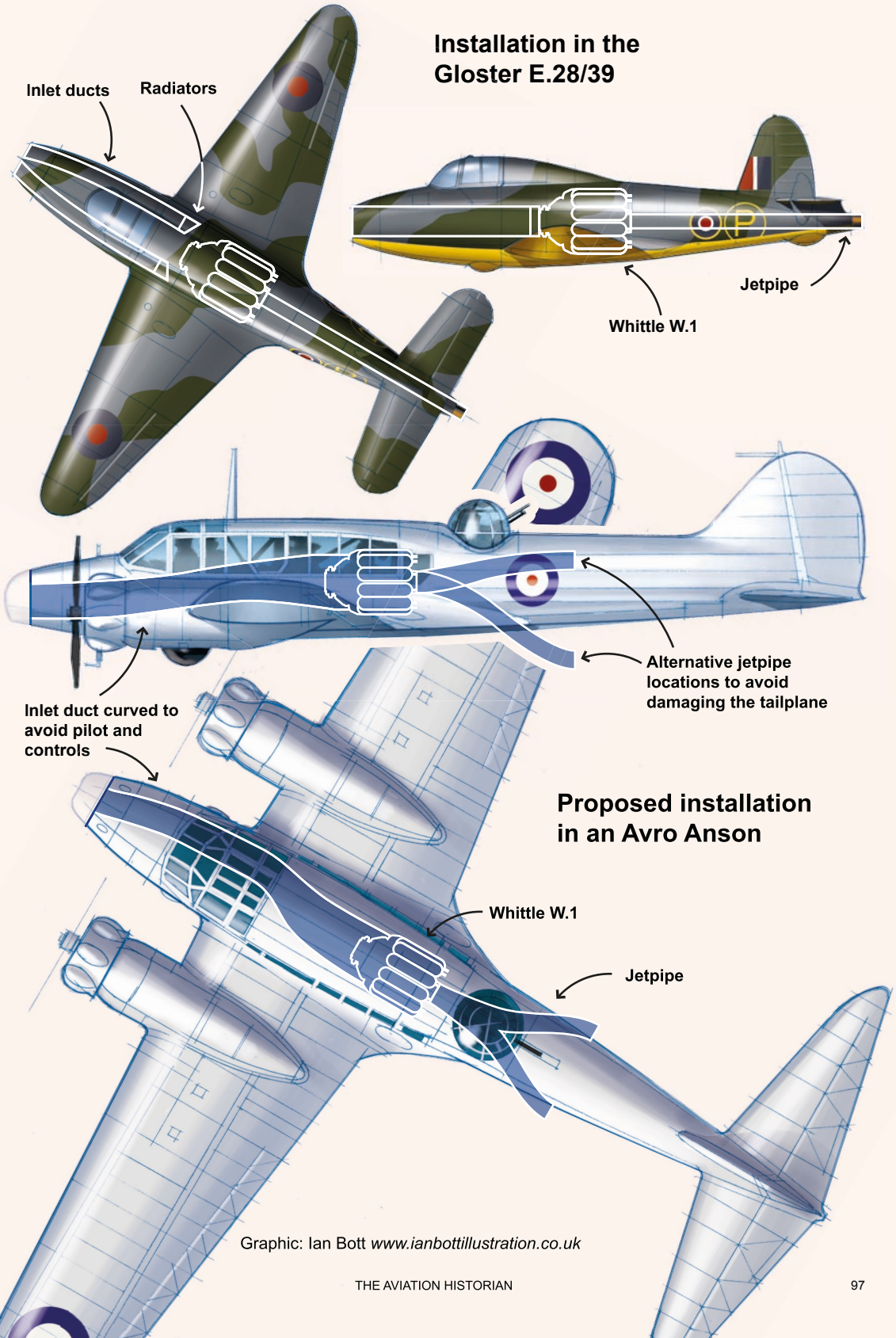
ACKNOWLEDGMENTS *The Editor would like to thank Mick Jeffries, on whose initial research this article is based, and who provided the impetus for its publication*

Two Gloster E.28/39s were built, W4041 and W4046, the second making its first flight on March 1, 1943. Both were extensively tested by RAE and Service pilots at Farnborough, where this photograph shows an E.28/39 being put through its paces. Had an Anson been fitted with a W.1, it would have required the incorporation of a similar nose intake.

TAH ARCHIVE



INSTALLING THE WHITTLE W.1 JET ENGINE



Graphic: Ian Bott *www.ianbottillustration.co.uk*

A SKY FULL OF FRONTIERS

CHARLES F. BLAIR · A LIFE IN AVIATION

In a field of endeavour crowded with dynamic, resourceful trailblazers, few showed more enterprise than Charles F. Blair, whose 50-year flying career included record-setting transatlantic adventures in flying-boats and the first solo flight across the North Pole. **MAURICE WICKSTEAD** chronicles the remarkable achievements of this consummate airman

IN 1928, A YEAR before America's Wall Street stock market crash, a young 19-year old man from Buffalo, New York, made his first solo flight with the Ryan Flying School at San Diego. His name was Charles Francis Blair Jr and this event would mark the start of a distinguished aviation career that would span five decades and encompass many remarkable achievements.

In 1931, having gained a Bachelor of Science degree in mechanical engineering from the University of Vermont, Blair enlisted in the US Navy Reserve and entered the Naval Flying School at Pensacola, Florida. Passing out with the rank of Ensign in August 1932, Blair was posted to Patrol Squadron VP-7F stationed at Naval Air Station (NAS) North Island, San Diego, the birthplace of American naval aviation.

The next year was spent flying Douglas PD-1 flying-boats on leisurely coastal patrol duties. A ten per cent reduction in the US Navy's budget, however, meant that it could no longer extend active duty to its reservists. Cut loose after just a year's military service, with 700 flying hours to his credit, Blair headed for Cheyenne, Wyoming, where he had heard that United Air Lines (Boeing Air Transport) was hiring copilots for its new fleet of Boeing 247 airliners. His application met with a blunt refusal from United's Chief Pilot, Harold Turner "Slim" Lewis, who seemingly preferred "landlubbers" to former naval aviators.

With the USA in the grip of the Great Depression, decent flying jobs were hard to come by, so Blair returned his attention seawards towards Pan American Airlines (PAA), then operating a fleet of Sikorsky flying-boats around the Caribbean and down to South America. While Blair was awaiting a response from PAA, Lewis apparently had a change of heart and offered

the aspiring young pilot a right-hand seat with United, which Blair eagerly grabbed. As it transpired, not long afterwards PAA also offered him a flying job; ironically, he would become a senior pilot with the global airline 17 years later.

Assigned to the Cheyenne—Salt Lake City sector of United's northern transcontinental route between New York and Seattle in June 1933, "Charlie" quickly learned his trade under the guidance of veteran airmail pilots such as Henry Boonstra, Hamilton "Ham" Lee and the legendary Jack Knight. Punctuated by mountains up to 8,500ft (2,600m) and with little in the way of navigation aids other than the lighted airway beacons, the 390-mile (630km) leg was often flown during the hours of darkness. In 1936, seeking to improve this situation, Blair bought a bubble sextant and taught himself celestial navigation, a technique he gradually introduced to other United pilots, and one that would stand him in good stead for the years ahead.

SWAPPING MOUNTAINS FOR OCEANS

In 1940, Blair, as he put it in his autobiography *Red Ball in the Sky* (Jarrolds, 1970), "found myself boss pilot of a new overseas airline". This was American Export Airlines (AEA), formed in April 1937 by a long-established shipping company, the American Export Line (AEL). In 1928 the line had been the USA's largest on the North Atlantic, with 22 ships plying much of its trade between New York and the Mediterranean. But by the mid-1930s its once-modern passenger-cargo vessels were looking decidedly sedate against the new breed of European passenger liners. Endeavouring to counteract this serious competition, AEL decided to form its own transatlantic airline.

In May 1939 AEA made an application to the newly-formed Civil Aeronautics Board (CAB) for routes to England and France. That summer three survey flights to France, Ireland and Portugal were completed by Consolidated 28-4 (PBY Catalina) NC18997, named *Transatlantic*. By the time the CAB began its hearings Europe was already at war, and, with Lisbon now the only available European air gateway, AEA amended its application — although it was not until July 15, 1940, that President Roosevelt approved a seven-year temporary permit.

Although AEA had many supporters, including the Post Office and the US Navy, the "upstart" airline was always going to be up against the mighty PAA, which saw AEA as a threat to its self-appointed "chosen instrument" status. A foretaste of future events came soon after AEL attempted to purchase a controlling interest in Lowell Yerex's Central American TACA operation in October 1940. Within three months, TACA's Guatemalan franchise had fallen victim

ALPHA ARCHIVE

ABOVE ***Charles Blair gives a cheery wave from the cockpit of North American P-51C N1202*** **Excalibur III** ***before setting off for Alaska from Bardufoss in Norway to complete the first solo transpolar flight in May 1951. Blair's attachment to the name*** **Excalibur** ***endured, the aviator applying the moniker to a total of eight aircraft.***

to a competitor airline *(Aerovias de Guatemala)* financed by PAA. Ultimately, AEL was forced to abandon its Latin American aspirations after the CAB, under barely disguised pressure from AEL's rival, denied permission for the take-over in August 1941.

Adding to this disappointment, the Portuguese decided that they did not need another American carrier serving Lisbon. Furthermore, while AEA had hoped to recoup some of its vast expenditure with the award of a substantial mail subsidy, even this was denied by a narrow vote in the Senate Appropriations Committee, no doubt influenced by strenuous lobbying by PAA. Undeterred, AEA had meanwhile placed an order — at a total cost of $2·1m — for three giant Sikorsky VS-44 flying-boats, the speed and range of which eclipsed even that of PAA's Boeing 314s.

The airline's unlikely saviour was Japan's attack on Pearl Harbor and America's entry into the war in December 1941. On January 12, 1942, a contract was signed between AEA and the Naval Air Transport Service (NATS) to operate a wartime courier service across the Atlantic. After a five-year battle for recognition, AEA received confirmation in February 1942 with the granting of a temporary certificate to fly between New York and Foynes in Ireland's County Limerick.

Blair had spent much of the summer of 1941

ALPHA ARCHIVE

ABOVE ***Only three Sikorsky VS-44s were built, plus one military XPBS-1, on which the commercial variant was based. The first to fly, NX41880 (later NC41880), seen here, made its maiden flight on January 18, 1942, with Blair at the controls. The original*** **Excalibur** ***crashed taking off at Botwood on October 3, 1942, killing 11 of the 37 aboard.***

recruiting and training flight crews, converting them to seaplanes during a series of sorties around the Caribbean in the PBY. Later he resorted to poaching top transcontinental pilots, not least from his old employer, United. Early in 1942 AEA's first Sikorsky was ready and Blair journeyed to the manufacturer's plant at Stratford, Connecticut, to undertake its maiden test flight on January 18, 1942.

INTO ACTION

Four months of intensive testing followed, mostly from NAS Jacksonville in Florida, after which the new flying-boat was awarded its commercial licence. In mid-May and early June, a couple of transatlantic survey flights were conducted before the first regular service, which departed New York's La Guardia Marine Terminal for Foynes on June 20, 1942, commanded by Blair in VS-44 serial NC41880, named *Excalibur*. All three aircraft, known as "The Flying Aces", reprised the names of AEL's top ocean-going ships (the original "Aces"), the others being *Excambian* (NC41881) and *Exeter* (NC41882).

The return flight on the following day, carrying Sir Andrew Cunningham, C-in-C of the Royal Navy's Mediterranean Fleet, and 15 passengers, overflew the scheduled stop at Botwood, Newfoundland, and continued direct to New York, where it landed after 25hr 40min aloft, having consumed all but 95gal (360lit) of the 3,500-odd gallons (13,250lit) of fuel in the tanks.

Tragedy struck the airline in October 1942 when *Excalibur* failed to get airborne from Botwood after the flaps became fully extended during the take-off run and it stalled before crashing back into the sea. This left just two VS-44s to maintain the contract, although they were augmented by some US Navy Consolidated PB2Y Coronado flying-boat transports. Nevertheless, the vital service was continued uninterrupted until the end of December 1944, when the contract expired.

The VS-44 was the only commercial aircraft capable of flying the Atlantic non-stop and soon established several records; fastest from Europe to North America (16hr 57min) in July 1944, and a non-stop distance record of 3,329 miles (5,358km) that October. The type also served on wartime South Atlantic supply flights between Bermuda, Trinidad, Puerto Rico and Africa, flying this southerly route to avoid the strong winter westerlies over the more usual northern track.

In between regular transatlantic crossings, Blair also found time to undertake production test pilot duties for Grumman, testing the F6F Hellcat, F7F Tigercat and F8F Bearcat naval fighters. He also flew the original Martin XPB2M-1 Mars flying-boat as a consulting test pilot. Military support flights, which resumed for a brief period in January 1945, saw Blair and AEA operating Douglas C-54s between the USA and Casablanca, Morocco, on behalf of Air Transport Command.

With the return of peace, under an enlightened CAB charged with promoting fair and equitable allocation of routes, AEA was authorised to serve the whole of Europe north of the 50th Parallel. In

HOWARD LEVY

ABOVE ***The third VS-44, NC41882*** **Exeter,** ***in AEA's wartime colour scheme of sky-blue upper surfaces and fuselage and light grey undersides, probably at the Marine Air Terminal, La Guardia, circa June 1942. This too was lost, in Uruguay on August 15, 1947, some time after the aircraft had passed through several ownerships after AEA.***

the meantime, PAA had dragged AEL through the courts using a section of the Civil Aeronautics Act that made it unlawful for any common carrier to acquire control of an airline. Although this was an arguable technicality, the CAB eventually concurred, leading to the sale of 61·9 per cent of AEA to American Airlines on December 10, 1945, creating American Overseas Airlines (AOA).

Blair, who had made the final AEA flying-boat return crossing, in *Excambian* on October 2, 1945, now switched to the DC-4, six of which had been delivered to AEA that September. On October 24, 1945, Blair was in command of AEA's first transatlantic landplane service between New York, Shannon and Bournemouth (Hurn), then the UK's stopgap airport for London, in a record time of 14hr 5min. When the airline began re-equipping with Lockheed Constellations in June 1946 it shared honours with PAA as one of the first carriers to land at the newly-opened London Airport at Heathrow (see pages 46–55 in this issue). Three years later the AOA fleet was augmented with Boeing Stratocruisers, in which Blair conducted many of the early proving flights and first scheduled runs with the new equipment.

MOONLIGHTING

Although no longer chief pilot, Blair still retained a high seniority number that allowed bidding for many of the "plum" trips and schedules. This left a great deal of spare time, during which he endeavoured to supplement his salary (then around $700 per month) with some "off-airways" flying. In the autumn of 1945 he hooked up with Dr Ralph Cox, whom he had recruited as a pilot for AEA three years earlier. Cox qualified as a dentist in 1938, but soon got bored and signed up for the US Army Aviation pilot programme before joining the Navy as a patrol pilot until 1941.

After the war Cox gathered together a group of aviation and business people to launch "Topper the Flying Lobster", with the intention of flying the highly desirable fresh crustaceans from Maine to New York for the latter's restaurant trade. For a financial contribution, Blair became Vice-President, but the ambitious plan came to naught and Cox leased a Douglas DC-3 to transport winter-weary New Yorkers south to the sunnier climes of Florida instead.

Another extra-curricular opportunity arose in 1947, when Blair was approached by AOA's vice-president, Jim Eaton, to organise an airlift of 300 construction workers and their equipment to Keflavik in Iceland, where a terminal building and hangars were being erected. The airline already had a base in Iceland for its regular flights en route to Europe, but lacked the capacity to undertake this contract. Specifically for the purpose, Blair set up himself up as Associated Air Transport and begun hunting around for a suitable aircraft to lease. With limited options, Blair latched on to the *Bermuda Sky Queen* (NC18612), one of several surviving PAA Boeing 314s, then owned by a small outfit named American International Airways. Having seemingly negotiated a lease, Blair and the first 40 workers turned up early one

Formalised in December 1945, American Export Airlines had merged with American Airlines the previous month, the newly-minted American Overseas Airlines becoming the transatlantic division of the American Airlines System, as per the legend on the fuselage of Douglas C-54 NC90905 (c/n 27344), named* Flagship Boston*, seen here at Heathrow in May 1946.

morning at Brooklyn's Floyd Bennett Field, only to find they could not gain access to the flying-boat at anchor in nearby Jamaica Bay without paying a significantly swollen fee to the owners, who, in Blair's words, were "applying the heat".

Swift action was required to avoid defaulting on the terms of the contract, and after much fraught negotiation, the one-off use of Cox's DC-4, NC58021, fortunately about to depart for Europe via Iceland, was secured. Solving the problem long-term, Blair was reunited with *Excambian*, hired from Skyways International, an expanding Miami-based freight charter company. Renamed *Reykjavik,* the flying-boat helped to complete the contract ahead of schedule, flying an average of 11hr daily over 30 consecutive days.

With some money in the bank, Blair extended his relationship with Skyways International, which was in need of a second Curtiss C-46 Commando to develop its lucrative transatlantic and Middle East business. Sensing another opportunity to improve his financial situation, Blair selected a suitable example from the release of war surplus stocks at Walnut Ridge, Arkansas, for an outlay of just a few thousand dollars. Following extensive overhaul and modifications the C-46, equipped with an additional fuel tank and named *Excalibur II*, was made ready for its first commercial trans-atlantic sortie in January 1948.

Hauling medicines and oil-rig spares eastbound and returning with displaced European refugee immigrants to Venezuela, with a guaranteed $6,000 per round-trip and minimal expenses, Blair's bank balance was soon on the up again. So much so that he purchased a second C-46. The brief window of commercial opportunity was about to close, however, as more operators jumped on the bandwagon, C-46s now being obtainable for just $1,500 down, with the balance repayable over 36 months. What had been a profitable operation was transformed into one that barely covered costs. As a result, activity was switched to hauling beef carcases from Nicaragua to Cuba and the Puerto Rico—New York immigrant trade, with only slightly better results.

Blair headed to Europe in search of more lucrative trade. While there he hooked up with a small company needing a larger aircraft to transport war refugees from Munich to Palestine. With Blair unwilling to fly over the Alps in winter, the point of departure was switched to Marseille; but, after seven trips that had transported a total of 350 souls to a new life, the French authorities raised objections. Late in 1949, after a six-week sojourn at Geneva costing thousands of dollars, the C-46 returned to the USA to resume the New York—San Juan shuttle, but Blair decided to quit while he was still marginally ahead.

INTO THE RECORD BOOKS

In early 1950, having long been intrigued by the prospect of setting speed records, and with money in the bank from the sale of the C-46, Blair turned towards a new and exciting challenge — a single-engined solo circumnavigation of the world. After much consultation with seasoned air-racing pilots, he settled on acquiring a North American P-51C Mustang and, by a fortunate coincidence, discovered that celebrated air racer and former Hollywood aerial stuntman Paul Mantz was willing to part with one of his two examples. However, Blair's hopes for a global circumnavigation attempt were dashed when North Korean forces crossed the 38th Parallel at the end of June 1950. Having modified the aircraft with the latest variant of the Rolls-Royce Merlin engine and additional fuel and oxygen equipment, Blair undertook a "shakedown" trip to Alaska with his new mount instead.

Next, Blair elected to try for an eastbound

Dallas-built P-51C N1202, named* Excalibur III*, is refuelled at Bardufoss in northern Norway before its transpolar flight in May 1951. The Mustang's previous owner, Paul Mantz, had removed the 90gal self-sealing wing tanks and converted the entire wing into one big fuel tank ("wet wing"), thereby significantly extending the aircraft's range.

transatlantic speed record and in the early hours of January 30, 1951, Mustang N1202, named *Excalibur III*, took off from Idlewild airport in New York for London Airport, where, after riding the jetstream at an average speed of around 450 m.p.h. (725km/h), it arrived 7hr 48min later, a record for single-engined piston-powered aircraft which still stands today.

Not content with lopping more than an hour off the transatlantic record, Blair set off on an even more taxing adventure four months later. On May 29, 1951, *Excalibur III* departed Bardufoss, Norway, for Alaska via the North Pole. Today over-the-pole flights are routine, but back then, before the advent of inertial navigation systems and GPS, Blair could rely only on his expertise in celestial navigation and a war-surplus sun compass, costing just $12.50. After an exhausting passage of some 10½hr covering 3,260 miles (5,245km), beautifully described in *Red Ball in the Sky*, Blair landed safely at Ladd Field, near Fairbanks. While over the pole he also took care of a personal errand, dropping a letter addressed to Santa Claus from his young son Chris. A year later Blair received the coveted Harmon Trophy from President Harry S. Truman at the White House. He was also one of the few recipients of the Norwegian Aero Club's Gold Medal.

By this time Blair had become an employee of PAA, which had taken over AOA in September 1950. His seniority still allowed plenty of time off for other aviation activities and in the spring of 1952, having resigned his Naval Reserve commission, he transferred to the USAF Reserve, acquiring the rank of Brigadier-General. After combat training in the Republic F-84 Thunderjet, Blair was assigned to Strategic Air Command's 31st Fighter Wing, where, when not working his "day job" with PAA, he spent up to 200hr a year helping to develop navigation and weapons-delivery systems for the new breed of nuclear-armed tactical aircraft.

The culmination of this tinkering with "black boxes", an experiment named Operation *Shark Bait*, was designed to test the rapid deployment of fighter aircraft from the USA to Europe, as well as explore a new electronic guidance and navigation system Blair had helped to develop. Flying F-84F 51-1741, named *Excalibur IV*, Blair and his two wingmen departed McGuire AFB, New Jersey, on April 18, 1956, arriving at RAF Wethersfield in Essex around 7hr later, having completed a single

Excalibur III ***was no stranger to long-distance flying, Mantz having established American coast-to-coast speed records in both directions with the scarlet-painted aircraft in 1947, then named* Blaze of Noon*. Pan Am bought the aircraft from Blair in 1953 and donated it to the Smithsonian Institution. Artwork by JUANITA FRANZI / AERO ILLUSTRATIONS © 2017***

USAF x 2

ABOVE LEFT ***Blair (centre) and his two wingmen, Capt Cesar Martinez (left) and Maj Robert Tomlinson, beside F-84F 51-1741*** **Excalibur IV** ***before taking off on Operation*** **Shark Bait** ***in April 1956.*** **ABOVE RIGHT** ***Blair and his groundcrew chief huddle beside a Boeing B-47 at Lake Charles AFB, Louisiana, before a star-tracking test flight.***

air-to-air refuelling off Newfoundland, and without the use of any ground-based radio aids.

On August 8, 1959, swapping the Thunderstreak for a North American Super Sabre, Blair led Operation *Julius Caesar*, in which a pair of two-seat F-100Fs, named *Excalibur V* and *Pole Cat*, flew from RAF Wethersfield to Eielson AFB in Alaska, thus completing the first transpolar flight by operational fighter aircraft. The 5,405-mile (8,700km) flight was completed in 9hr 37min. Along the way the pair tested two new precision-navigation computers and explored the feasibility of transferring tactical aircraft across the Arctic. For this and previous work, Blair received the accolade of the Institute of Navigation, for an "outstanding contribution to the science of navigation". Military recognition came with award of the Distinguished Flying Cross.

In between such activities Blair still found time to contribute numerous articles to journals such as *Popular Science* and *Flying*, as well as co-write a novel with A.J. Wallis, *Thunder Above* (Henry Holt, 1956), which became the basis of the 1960 British film *Beyond the Curtain.*

When PAA began taking delivery of its Boeing 707s in late 1958, Blair was a prime candidate to transfer to the state-of-the-art new jeliner, having already amassed flight time on the USAF's Boeing B-47 bomber and many other military jets. He was soon flying Pan Am's PA1 around-the-world service and other long-hauls down to Rio de Janeiro in Brazil and Buenos Aires in Argentina.

In 1962, Blair, still restless, took on new responsibilities by joining the National Aeronautics & Space Administration (NASA) as a consultant on operational and navigational issues related to proposed supersonic transport aircraft.

In the early 1960s Blair set up home on St Croix in the US Virgin Islands. While an idyllic location, it was highly inconvenient when travelling to wherever Pan American needed his services. Although St Croix boasted a small airport, a relic of the Second World War, its only service was the twice-daily Caribair Douglas DC-3 run to St Thomas and San Juan, Puerto Rico. Otherwise, escape could only be made by ferry, an often uncomfortable journey over the 43 miles (69km) of sea northwards to St Thomas, where better onward travel options were available.

GOOSING AROUND THE ISLANDS

To overcome this disadvantage, Blair bought a Grumman Goose amphibian, for $10,000, but frequent requests from others for lifts started eating into his leisure time. This led to the creation of Antilles Air Boats (AAB), which was established on February 1, 1964. Helping Blair get the new venture up and running was another Pan Am veteran, Capt Marius "Lodi" Lodeesen, who subsequently became the fledgling airline's Vice-President. Flying between the harbours of Christiansted on St Croix and Charlotte Amalie on St Thomas, the new airline cut the sea crossing from 4hr to 30min. Before a dedicated seaplane ramp was built at St Croix, early travellers were still in for something of an adventure, being ferried out to the moored Goose by a pair of 16ft Boston whalers.

Initially Blair and another part-time pilot covered the schedule, but as business grew two

ALPHA ARCHIVE

ABOVE ***Grumman G-21A Goose N79901 was one of more than 30 amphibians ultimately operated by Antilles Air Boats, the company established by Blair in the US Virgin Islands in 1964. It is seen here at Long Beach, California, in July 1969, around the time it joined the company. By 1974 AAB was operating more than 100 daily scheduled inter-island services.***

LEFT ***A touch of glamour — Charles Blair and Maureen O'Hara in the cockpit of VS-44*** **Excalibur VII** ***(the former*** **Excambian***), which AAB acquired from Avalon Air Transport in 1968. O'Hara starred in numerous films with John Wayne, who became a regular visitor to the Blairs' home on St Croix, and who said of his frequent co-star, "She's my kind of woman . . . a great guy".***

more Goose amphibians were acquired and extra staff hired. Within five years the fleet amounted to eight aircraft, operating up to 20 round-trips daily plus additional flights to St John and Tortola and later, Puerto Rico. The new service quickly gained popularity, and as passenger numbers rapidly increased (93,000 in 1967), larger equipment was needed to cope with demand.

In 1968 Blair turned again to his beloved VS-44, purchasing the sole airworthy example (*Excambian*, renamed *Excalibur VII*) from Avalon Air Transport for $100,000. Arranged in a 43-seat configuration and nicknamed "Mother Goose", the big flying-boat operated the twice-daily "Super Goose" inter-island service. It flew services for about a year, completing around 1,000 trips before being badly damaged hitting rocks after a landing at Charlotte Amalie on January 3, 1969. Beached and reportedly used as a hot-dog stand for a while, it was donated by Blair to the National Museum of Naval Aviation at Pensacola in 1976. In 1983 it was permanently loaned to the New England Air Museum at Windsor Locks, Connecticut, where it was restored in its original AEA colours and where it remains displayed today.

Three Catalinas were added to the AAB fleet in 1970 to handle charters and to provide extra capacity. As passenger numbers rose (200,000 in 1970) the Goose fleet grew apace; more than 20 examples eventually passed through the airline's hands. As a result the unique airline soon gained the affectionate title "The Goose", which was used to good effect in its publicity material.

All of this aerial adventuring came at a cost, however, and, two years before retiring from Pan Am in 1969 at the age of 60, Blair went through the break-up of his third marriage. Good fortune was about to come to his aid yet again, for in March 1968 he married celebrated Hollywood film actress Maureen O'Hara. The pair had first met late in 1946, when O'Hara was returning to Ireland on an AOA flight. Nervous about flying since a rough nationwide publicity trip by air with Lucille Ball in 1940, she was reassured by being welcomed aboard by Captain Charlie.

VIA AUTHOR

ABOVE ***After having been left derelict in Peru after a stint in South America in the 1950s, N41881 was acquired by Avalon Air Transport of California, which used it for the tourist trade to and from Catalina Island during 1957–67. It then passed to AAB, in whose colours it is seen here while in outside storage after being damaged in early 1969.***

Since then the pair had remained firm friends and met up whenever their paths crossed, but without any hint of romantic attachment. For both it was third time lucky. They made a glamorous couple; the rugged man-of-action aviator and the popular and acclaimed film actress. Blair was no stranger to the celebrity lifestyle; his occupation afforded many opportunities to rub shoulders with the great and the good, and among close associates and friends he counted figures from the worlds of showbusiness, politics and the military. Three years later O'Hara made her last major motion picture and settled down to life in Blair's substantial property on St Croix, helping him run his airline business. Later, he bought the *Virgin Islander* magazine, of which she became the Managing Editor.

Shortly before retiring, Blair had completed a farewell scheduled round-the-world trip for Pan Am, accompanied by the new Mrs Blair. His globetrotting days were far from over, however. In late 1974, with his airline earning more than $2m in annual revenues but lacking a large flying-boat, Blair jumped at the opportunity to pick up the last two remaining Short Sandringhams recently retired by Ansett Flying Boat Services in Australia. After successful negotiations, the first Sandringham, VH-BRF (*Islander*, given the temporary American registration N158J and renamed *Excalibur VIII*) left Sydney for its new home on September 25, 1974, flown by Blair and copilot Capt Lloyd Maundrell from Ansett, with O'Hara handling cabin services. The second aircraft, VH-BRC (*Beachcomber*, temporarily registered N158C and renamed *Southern Cross*) arrived at St Croix on December 9 after an 11-day ferry trip, again with Blair at the controls.

The intention was to use the pair of flying-boats for luxury air cruises around the Caribbean, but of the two, only *Southern Cross* ever saw any regular

Short Sandringham c/n 2018, formerly ZK-AMH (1947–49) with TEAL and VH-BRC with Ansett Flying Boat Services (1952–74), was acquired by Blair's Antilles Air Boats in September 1974. It is seen here at Rose Bay, Sydney, with temporary American registration N156C, before its departure for the Virgin Islands that November.

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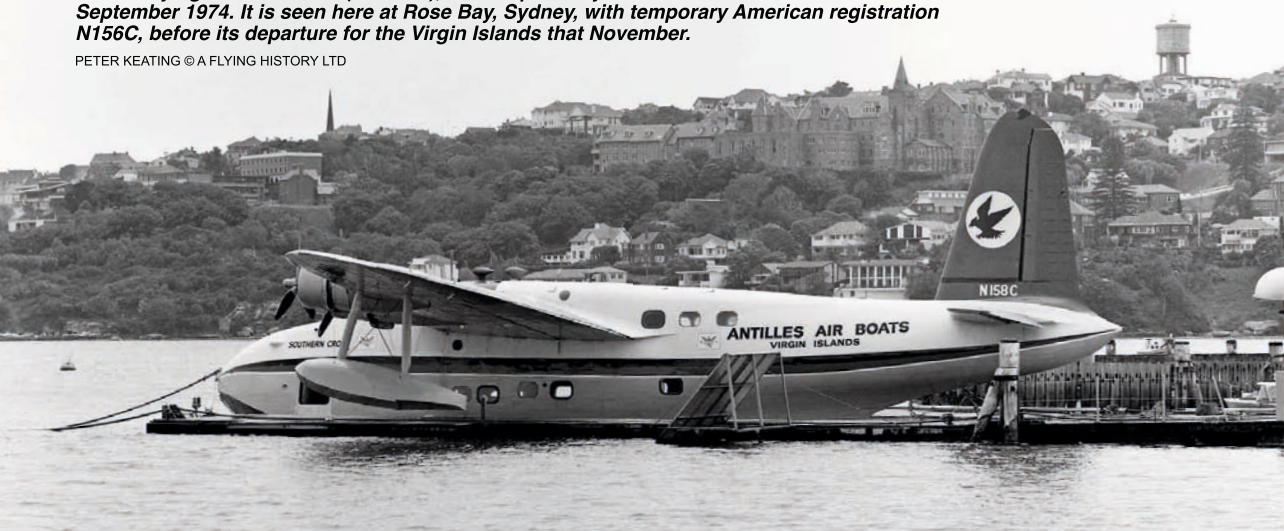

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ABOVE ***Another former Ansett machine,* Excalibur VIII *operated only one service with Antilles Air Boats, on January 15, 1975, and was little used otherwise owing to certification problems. Seen here at Rose Bay in 1974 with temporary registration N156J, the flying-boat now resides at Kermit Weeks's Fantasy of Flight Museum.***

service, *Excalibur VIII* having hit American certification problems. It was later sold to Sir Edward Hulton in the UK. In July 1976 Blair took *Southern Cross* back across the Atlantic to his old stamping ground, Foynes in southern Ireland. The purpose was a nostalgic vacation trip for the Blairs to visit their holiday home and at the same time offer pleasure flights. While there he met up with another transatlantic veteran, Capt Kelly Rogers of Imperial Airways flying-boat fame. The Sandringham continued westwards for a few days' pleasure-flying based near Poole Harbour in late August the same year, with this excursion being repeated the following summer under charter to Irish operator Aer Arann for tourist trips down Ireland's west coast.

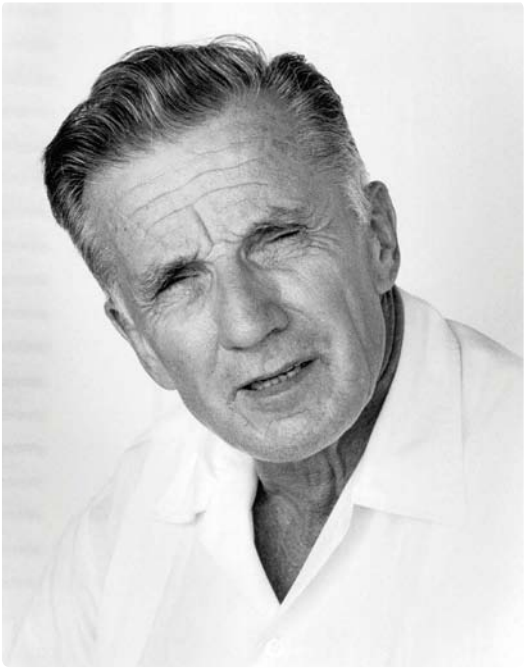
Following a crash at St Thomas in April 1976, American Airlines switched its regular Boeing 727 flights to St Croix, pending improvements to the runway at St Thomas. Rather than use AAB's shuttle, it created American Inter-Island specifically to transfer its passengers between the two islands. From May 1977 several Convair 440s were employed, operated by AAB and flown by its pilots.

A few months earlier a happy reunion had taken place when O'Hara's long-time friend and acting partner John Wayne paid a visit, during which Blair took him on a "jolly" to Puerto Rico. On arrival they were greeted by two Federal Aviation Administration (FAA) officials, who informed them that they had made an illegal flight with only one certified pilot, having seemingly been tipped-off by a disgruntled former employee. With great presence of mind in a tight spot, Blair feigned astonishment saying, "Oh, come on. Haven't you guys ever seen *The High and the Mighty?*", referring to Wayne's airline pilot role in the popular 1954 film of Ernest K. Gann's novel. Like the consummate actor he was, John Wayne played along with great panache. Reportedly, the FAA officials backed down with an apology, not realising, of course, that Wayne had never flown an aircraft in his life.

THE FINAL FRONTIER

The transatlantic sorties in *Southern Cross* were to be Charlie Blair's swansong. On September 2, 1978, he was killed, together with three of the ten passengers aboard a routine Goose flight from St Croix to St Thomas. The aircraft, G-21A N7777V, was just five miles (8km) south of St Thomas when the port engine failed and, unable to sustain flight, the Goose crashed into the sea, cartwheeled and sank. The official accident report, published nine months later, heavily criticised Blair for attempting to continue flying the aircraft in ground effect, close to the surface instead of initiating a forced landing. It was also scathing about the carrier's maintenance operations and the local FAA office's failure to monitor the airline adequately.

The report highlighted almost 20 contributory factors. In fact, AAB had already been cited and heavily fined for maintenance and other violations back in March 1978, including unauthorised operation of the Sandringham on some 40 passenger flights, but this was never adequately followed up. By all accounts, Blair ran his airline pretty much as a one-man band, lacking any dedicated top management to



ALPHA ARCHIVE

LEFT ***Blair in the later years of his life; like many of his aviation pioneer contemporaries, he did not die quietly in his bed at home, but at the controls of one of his beloved aircraft, in September 1978. This distinguished airman's legacy lives on at the Charlotte Amalie Harbor Seaplane Base on St Thomas, the terminal of which is named in his honour.***

oversee key departments. While this may have worked satisfactorily in the early days with just a couple of aircraft, as the airline grew to a large fleet operating up to 120 daily services per day, the situation became untenable.

It was a tragic end to the career of a consummate airman, who, during a 50-year career, had clocked up more than 45,000hr of flying time, flown some ten million miles and made more than 1,600 Atlantic crossings without serious incident.

Although devastated, his wife took up the reins to keep the airline running, but it was an uphill struggle settling lawsuits and fending off the FAA, which seemed intent on closing AAB down. The ageing Goose fleet was replaced by a few Grumman Mallards and several Albatrosses, operating a reduced timetable covering just the US Virgin Islands.

While AAB was under O'Hara's tenure, the FAA's concerns were addressed by beefing up the management and appointing a designated head of maintenance. Negotiations to sell the airline were already in hand shortly before Blair's death, and in April 1979 these were finally concluded with Resorts International, a Miami-based hotel, casino and leisure company, which already owned another flying-boat operation, Chalks International. In her autobiography, *'Tis Herself* (Simon & Schuster, 2004), O'Hara relates how she discovered paperwork that led her to believe that the CIA had financed the purchase of some of the airline's aircraft. This perhaps explains why her husband was often to be seen in huddles with top military figures and why so many former military pilots were employed. The suspicion resurfaced when Resorts' president, James Crosby, having bought the airline, asked point-blank whether he should now consider himself a member of the CIA! Whatever the truth of the matter, there can be no denying that the airline would have been ideally placed to keep an eye on one of the American government's prime areas of concern in the region — Fidel Castro's Cuba.

O'Hara stayed on as President/CEO for a while, but despite her loyal efforts Resorts International decided to close the airline down after failing to gain permission to develop its casino business in the US Virgin Islands. On September 10, 1981, the operation was sold to Mickey Bronstein and two other New York investors, who revived it under the name of Virgin Islands Seaplane Shuttle. Employing several of AAB's Mallards, services recommenced on March 18, 1982, over some of the main routes flown by its predecessor. A couple of de Havilland Canada Twin Otter floatplanes were subsequently added and from June 1988 flights were conducted on behalf of TWA Express. But after seven years of successful operation the company was forced to close down after Hurricane *Hugo* destroyed a substantial part of its fleet in September 1989.

After meeting some initial resistance, Maureen O'Hara succeeded in laying her late husband to rest in Arlington National Cemetery in Virginia with full military honours. A few other memorials to his achievements still survive; the famous record-setting Mustang now hangs in the Steven F. Udvar-Hazy Center, part of the Smithsonian National Air and Space Museum, at Washington Dulles International Airport. A scale replica of the P-51 was located in the Queen's Building at Heathrow, alongside a memorial plaque, until the building's demolition began in late 2009.

The two Sandringhams still survive; *Southern Cross* takes pride of place at Southampton's Solent Sky Museum, while *Excalibur VIII*, given the American registration N814ML in 1993, forms part of the Kermit Weeks Fantasy of Flight Museum in Florida. The same tropical storm that devastated AAB's successor also destroyed the Blairs' home on St Croix, O'Hara returning to her native Ireland to take up residence. While there, she became a patron of the Foynes Flying Boat & Maritime Museum, and in 2006 she attended the reopening of the refurbished museum, where a substantial exhibit is dedicated to her husband.

Charles Blair was often quoted as saying "the sky is full of frontiers"; in an eventful life full of aviation accomplishments and adventure, he certainly explored more than most.

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the flying darkroom

The Siebel Si 204 & Nord NC.701 in Sweden

The Siebel Si 204 is best known for its wartime role as a ubiquitous light transport and trainer for the Luftwaffe; much less well-known is the extensive use of its French-built variant, the Nord NC.701, as a photographic and mapping platform in post-war Sweden. Scandinavian aviation historian **JAN FORSGREN** profiles the Swedish career of the distinctive twin-finned, "goldfish-bowl"-nosed workhorse

THE TWIN-ENGINED Siebel Si 204 was a development of the German Klemm Flugzeug Halle Fh 104 Hallore, a design taken over by Siebel Flugzeugwerke K.G. of Halle an der Saale in central eastern Germany in the late 1930s. Only 46 Fh 104s were built, while the larger Siebel Si 204 entered large-scale production in 1943. In Luftwaffe service the Si 204 was used extensively as an advanced trainer and light transport. By the end of the war, more than 1,200 Si 204s, in two main variants — the Si 204A and Si 204D — had been built, and many former Luftwaffe Si 204s were pressed into service with the RAF as light transport/communications aircraft.

In France, SNCAC (*Société Nationale de Constructions Aéronautiques du Centre)* had been ordered by the Germans to build some 455 Si 204Ds, the first of these being assembled at the company's Bourges factory in 1942. A total of 168 had been assembled before the end of the war brought a halt to production. As the production lines were still fully functional, however, it was decided to continue manufacturing the type as the NC.700, to be redesignated in 1945 as the military Nord NC.701 and NC.702 civilian version. The latter had a conventional stepped windscreen instead of the distinctive "goldfish bowl" nose of its uniformed counterpart.

In 1949 SNCAC was liquidated, its assets being turned over to SNCAN *(Société Nationale de Constructions Aéronautiques du Nord),* which continued production of the NC.701/702 at the Bourges factory. Post-war production of the type also continued in Czechoslovakia, where 179 were built as the Aero C-3, most being supplied to the Czechoslovak Air Force as light transports.

The NC.701/702 remained in widespread use in France until the late 1960s, but by the early 1970s all had been retired from service. Few NC.701/702s have been preserved, and none remain in airworthy condition.

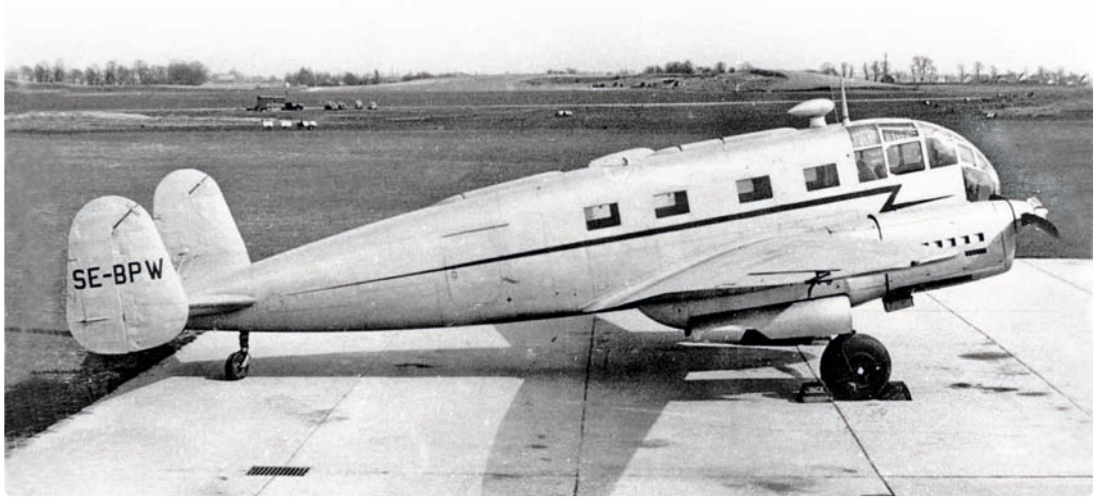
An unscheduled arrival

During the last months of the war, many Luftwaffe aircraft landed in Sweden, either as a result of navigational error or defection by German crews. Belonging to the latter category was the sole Siebel Si 204 to land in Sweden.

On April 19, 1945, Siebel Si 204D-1 Wnr 321583, D1+QK, belonging to 2./*Seeaufklärungsgruppe 126,* landed at Wing F 17 Kallinge in south-eastern Sweden. (Some sources state that the aircraft belonged to *Luftdienstkommando 65,* although this unit had been redesignated *1./Fliegerzielgeschwader* in early 1944.) Aboard were three refugees; two men — Gerhard Fleichman-Radnidzky and Erich Fiaa — and one 23-year-old woman, Renate Schmith. The Si 204 was equipped with FuG 200 radar equipment and was in excellent condition. Customs officers ripped up the floor and dismantled various panels in search of valuables. Nothing was found, however.

In 1948 the aircraft was sold to an enterprising aircraft mechanic and remained stored outside until 1951. The owner asked the technical department of the Wing for a cost estimate to refurbish the Si 204; the estimate was too high, and the owner decided to take matters into his own hands. As a result the rather tired Si 204D was prepared for a ferry flight to Bulltofta, near

OPPOSITE PAGE ***Nord NC.701 SE-KAE, one of the first two to arrive in Sweden, captured over a typical Swedish landscape.*** **BELOW** ***Siebel Si 204D SE-BPW was the only German-built example of the type to be put on the Swedish register, having been flown to Kallinge by war refugees in April 1945. The aircraft eventually returned to Germany as D-IBAB, and was broken up at Hamburg some time in the 1960s.*** ARLANDA CIVIL AIRCRAFT COLLECTION x 2



ARLANDA CIVIL AIRCRAFT COLLECTION

ABOVE ***Nord NC.701 SE-KAE in the 1960s, during its tenure with Sweden's National Mapping Department. The creation of topographical and economic maps had been a mlitary responsibility until 1937, when it was placed under civil authority. Sweden's survey work is now undertaken by*** **Lantmäteriet,** ***the National Surveying Authority.***

Malmö. According to contemporary reports, the pre-flight preparations merely consisted of pumping air into the tyres, connecting all the cables that had come adrift and putting petrol in the fuel tanks. The aircraft was then flown to Bulltofta airport, where it was extensively overhauled for onward sale. Two passengers joined the pilot for the ride, presumably in blissful ignorance of the previous lack of maintenance of the aircraft.

On April 28, 1953, the Si 204 was given the Swedish civil registration SE-BPW. However, six months later, on September 11, the registration was cancelled and the Si 204 was sold to a new owner, Viggo Sylvest Jensen, in Denmark, where the aircraft was registered as OY-ADA on February 1, 1954. The Danish registration was cancelled on July 20, 1955, and the Si 204 was subsequently sold to yet another new owner in Germany, where it was registered as D-IBAB.

More Siebels in Sweden

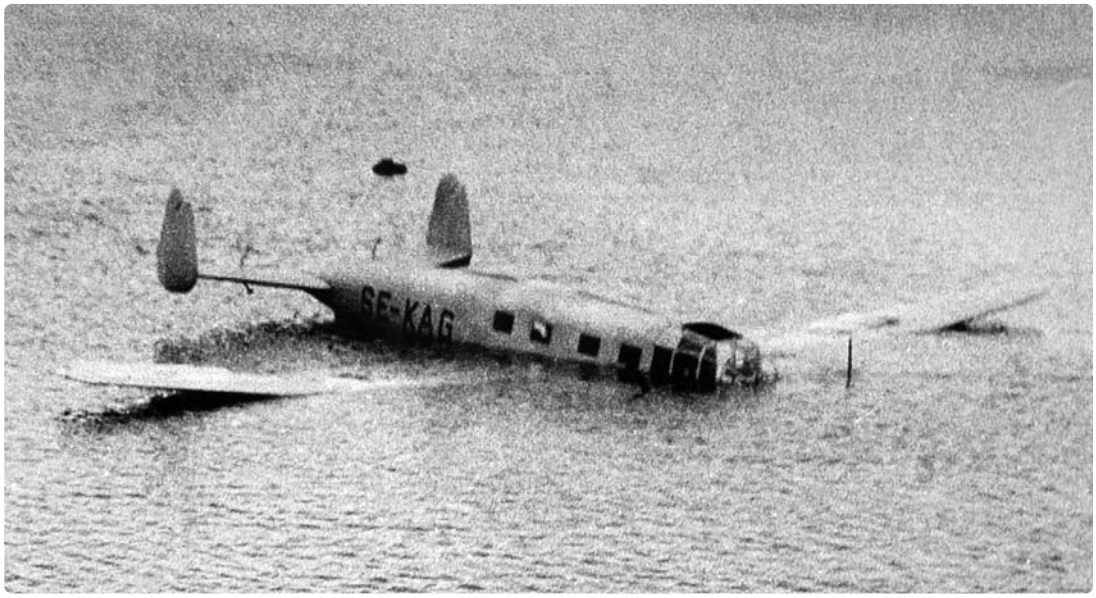
This was not to be Sweden's only connection with the Siebel Si 204, however. In 1947 *Rikets Allmänna Kartverk* (RAK — National Mapping Department) needed to replace its ageing fleet of Focke-Wulf Fw 58 Weihes then in use for air mapping and surveillance. Two of the RAK's four Fw 58s had been lost in crashes, creating a gap in operational capability that had to be filled, and rapidly. As a result, a search for a suitable aircraft was initiated.

During the summer of 1946 a French sales team had demonstrated a Nord NC.701 Martinet (French-built Si 204D) at Bromma Airport, north of Stockholm. The demonstration was evidently successful, as two NC.701s were ordered in late 1947, at a cost of 710,000 Kronor. The pair, c/ns 264 and 265, both factory-fresh, were delivered in April 1948 and registered as SE-KAE and SE-KAG respectively. Although the machines' formal designation was Nord NC.701, the RAK crews usually referred to the aircraft as "Siebels".

The NC.701 was deemed a considerable improvement over the Fw 58, having a much greater range and the ability to carry more equipment. The greatest advantage of the NC.701, however, was that it was equipped with a glazed nose section, making it eminently suitable as a camera platform. From the RAK pilot's point of view, the NC.701 was an excellent aircraft, being easy to fly and a stable aerial photographic platform. For example, performing flat turns in the NC.701 without using the ailerons was very easy. The only minor complaint was that the type could be difficult to land in a crosswind, being susceptible to groundloops. Also, as no de-icing equipment was fitted, problems arose while flying at high altitude or in cloud.

Initially, the NC.701's Snecma (Renault) 12S in-line engines caused numerous problems, being difficult to maintain. Although the manufacturer despatched a mechanic to Sweden, who was to become a frequent visitor, the engine problems were never fully resolved until new improved Snecma 12T engines were fitted in 1966.

In order to provide photographic negatives for the production of maps to 1:20,000 scale, pilots had to maintain an altitude of 4,600m (15,100ft). One of the cameras used for standard vertical photography was the Wild RC5, the negatives



LUFTFARTSVERKET VIA AUTHOR

ABOVE ***A rather waterlogged SE-KAG after its unmanned ditching in Lake Mälaren, a freshwater lake directly to the west of Stockholm. Just visible in this poor-quality photograph are the black marks left on the cabin roof by the shoes of the pilot, Rudolf Bryant-Meisner, who baled out of the open hatch in the roof of the glazed cockpit.***

for which were 30cm x 30cm (12in x 12in), each roll containing 35m (115ft) of film. One advantage of the NC.701 was the incorporation of a darkroom, located in the rear fuselage, for in-flight processing of the film. In 1950 tests with colour film were completed, although it was ultimately not proceeded with. The same year, heat-sensitive film was introduced.

The introduction of the NC.701 resulted in a significant increase in the number of photographs produced; in 1957 some 15,000 photographs were taken. On average, about 1,000 hours were flown each year. In 1951 the area around Trondheim in Norway was photographed, with visits to Denmark and Iceland following later. Apart from the usual missions, several exploratory flights for ore were also flown on behalf of Swedish mining company LKAB. For the crews, such missions provided a welcome different pace, as they were usually flown as low as 100ft (30m).

Everybody out!

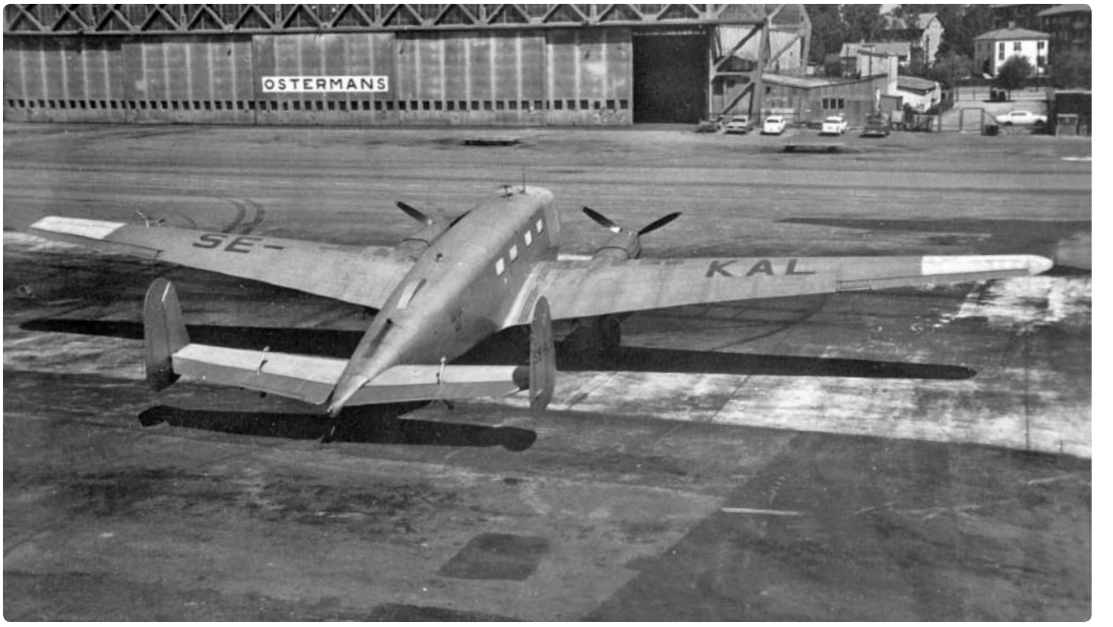
In 1949 RAK moved its operational base from the increasingly congested Bromma to Norrtälje, north-east of Stockholm. The ability to provide the best photographic material was very much dependent on the season, work usually beginning around the middle of March, when most of the snow in the southernmost parts of the country had melted away. Moving north above the snow line, northern Lapland, the northernmost part of Sweden, was usually reached about three months later, in mid-June. The most detailed photographs were taken before the spring leafing.

On April 18, 1952, SE-KAG was involved in an unusual accident. Having had a new camera worth 80,000 Kronor installed that morning, 'KAG took off from Norrtälje at 1330hr for an aerial survey sortie, but it soon became apparent that the weather was too poor for aerial photography. It was then discovered that hydraulic fluid was leaking from the starboard engine mounting.

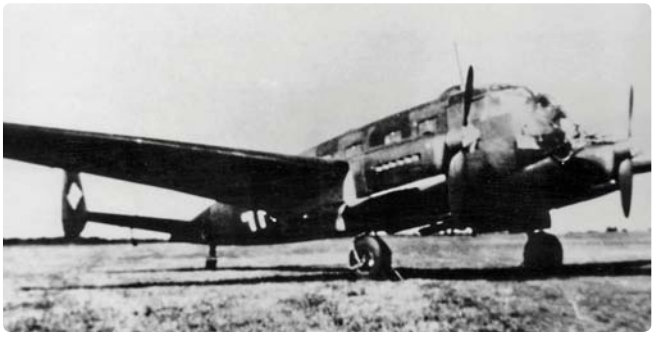
With hydraulic pressure being necessary to operate the undercarriage and flaps, this was a serious matter. When the pilot, Rudolf Bryant-Meisner, found that the starboard mainwheel had not retracted and refused to do so, air traffic control suggested an emergency landing on the grass field at Skå Edeby. An alternative novel suggestion was to remove the errant undercarriage by tearing it off against a cliff. Unsurprisingly, this idea was dismissed.

In the event the crew of five — Bryant-Meisner, Rüno Johansson (mechanic), Karl Gösta Sproge (map assistant), Stig Adolfsson (instrument mechanic) and Helge Evert Lindström (instrument mechanic) — baled out, all landing safely. Bryant-Meisner was the last to abandon the aircraft, at 1819hr, almost ending up in a power line. Sproge's parachute initially failed to open, and he had to pull it free. With Lindström making his first flight, having to bale out was a frightening proposition. He nevertheless made it down to terra firma safe and sound.

The NC.701 flew on and subsequently ditched in Lake Mälaren, about 200m (650ft) from Skytteholm Manor. The following day, Swedish newspapers carried headlines about the relatively happy ending of the story. A Grumman



ABOVE ***Showing the type's long tapered wings to good advantage, SE-KAL is seen here awaiting its next sortie at Stockholm's Bromma Airport, opposite the hangar of pioneering Swedish helicopter company Ostermans. The third NC.701 to be taken on strength by RAK, the former French Air Force aircraft was delivered to Sweden in 1963.***



LEFT ***A poor-quality but rare photograph of the sole Si 204 to visit Sweden, still in its Luftwaffe markings. The type made its first flight, in the form of the "stepped-nose" Si 204A, at the end of May 1941. The Si 204D, with its distinctive glazed nose, made its maiden flight the following year.***

BELOW ***Another view of SE-KAL at Bromma. The type was of conventional construction, with an all-metal structure, a single-spar wing and a dihedralled tail-plane of adjustable incidence with twin fins and rudders. The mainwheels retracted backwards into the engine nacelles.***

ARLANDA CIVIL AIRCRAFT COLLECTION x 3

SVEN STRIDSBERG VIA AUTHOR

Following its dunking in Lake Mälaren in 1952, SE-KAG was fitted with dual controls and continued its mapping work. It is seen here at Bulltofta in the mid-1960s. The RAK NC.701s wore various colour schemes during their tenure with RAK, but always with the Swedish national insignia, the* Tre Kronor *(three crowns), as seen here on the side of the fuselage.

Widgeon belonging to the daily newspaper *Dagens Nyheter* had flown alongside the NC.701 for more than two hours. It was subsequently reported that the crew had attempted to urinate into the hydraulic tube, trying to get enough pressure to extend the undercarriage. Unsurprisingly, this improvised solution failed. According to a former RAK employee, Bryant-Meisner had inadvertently kicked the propeller controls before departing the aircraft, which made the aeroplane undertake a series of shallow turns instead of ditching straight ahead into Lake Mälaren.

When recovered, it was discovered that the only damage to the aircraft, apart from the malfunctioning undercarriage, were two black lines on top of the fuselage. It transpired that when Bryant-Meisner had baled out, the soles of his shoes had inscribed these black lines. The NC.701 was recovered, refurbished and returned to service. During its refurbishment the aircraft was fitted with a second set of controls, in order to serve as a conversion trainer.

Three more NC.701s, all former French *Armée de l'Air* aircraft, were delivered in 1963. At least one contained German-built parts, with German manufacturing plates and insignia, including a swastika, noted during regular maintenance.

Nord NC.701 Martinet data

Powerplant 2 x 590 h.p. Snecma (Renault) 12S 12-cylinder inverted-V12 air-cooled piston engine, based on German Argus As 411

Dimensions		
Span	21·28m	(69ft 10in)
Length	12·57m	(41ft 3in)
Height	3·3m	(10ft 10in)
Wing area	46m²	(495ft²)
Weights		
Empty	3,965kg	(8,741lb)
Loaded	5,735kg	(12,643lb)
Payload	750kg	(1,653lb)
Performance		
Maximum speed	350km/h	(218 m.p.h.)
Cruise speed	315km/h at 2,000m	(196 m.p.h. at 6,550ft)
	325km/h at 3,000m	(202 m.p.h. at 9,800ft)
Normal take-off distance	350m	1,150ft
Service ceiling	7,500m	(24,600ft)
Range with 1,140lit (250gal) fuel	1,700km	(1,060 miles)
with 890lit (195gal) fuel	1,200km	(750 miles)

The end of the road

During 1966–67 RAK received a series of offers from Libya to complete a programme of surveillance flights in that country. However, in order to comply with international flight safety regulations, new radio equipment would have to be installed. The cost for this proved prohibitive, and the offer was turned down.

By the late 1960s the NC.701s were becoming somewhat weary and expensive to operate. One flying hour cost 45,000 Kronor, almost double that of the Aero Commander 680 offered to RAK by private company *Ehrenström Flyg AB*. Further problems ensued with the crash of a French NC.701, the cause being ascribed to a corroded engine bulkhead. During the subsequent inspection, all NC.701 bulkheads were X-rayed,

SVEN STRIDSBERG VIA AUTHOR

ABOVE ***Seen here at Arlanda in a natural-metal finish and dayglo bands on the outer wing sections and tailplane, SE-KAL is currently undergoing restoration by the Arlanda Civil Aircraft Collection. Its glazed nose gives it the appearance of a pocket-sized Heinkel He 111, the "goldfish bowl" being a popular configuration in the 1930s.***

corrosion being found on all of RAK's Martinets.

As a result, the remaining NC.701s were immediately grounded pending a decision regarding their future. In the event, the cost of replacing the corroded bulkheads proved prohibitive, and, coupled with the type's high operating cost, all NC.701s were withdrawn from service in late 1970. The NC.701 became the last type of aircraft to be owned and operated directly by RAK. Instead, from that point, various aircraft, mostly Aero Commander 680s, were leased on an as-needed basis.

The last flight of an RAK NC.701 occurred on December 30, 1970, when SE-KAE was flown to Malmslätt for preservation at the *Flygvapenmuseum*. The previous week, on December 23, SE-KAL had been flown by Iwan "Pimpo" Norrman to Arlanda in Stockholm. Initially, the airport fire service thought that it would be assigned the NC.701. This raised loud protests from the Arlanda Preservation Group, which eventually won the day. However, 'KAL was to remain parked at the fire service training area for the next three decades, slowly deteriorating.

On March 25, 2004, 'KAL was finally moved to its present location adjacent to the Arlanda Civil Aircraft Collection. Owing to a lack of storage space, as well as other ongoing restoration projects, the first steps of what will hopefully grow into a complete restoration of the aircraft were initiated in the summer of 2008. The other NC.701, SE-KAE, is currently stored at the Flygvapenmuseum, which has no plans to display it in the near future.

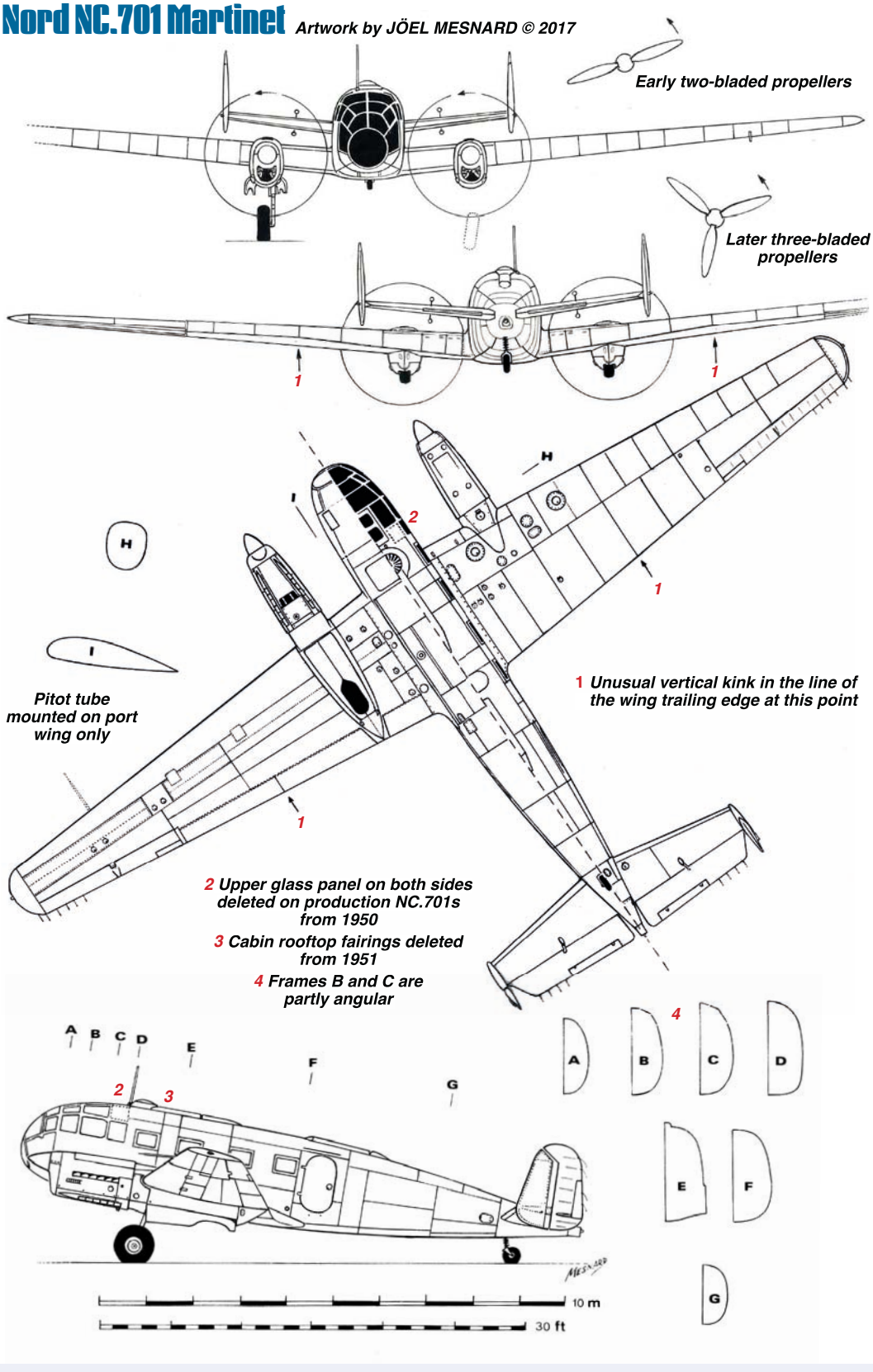
ACKNOWLEDGMENTS *The author would like to thank Sture Holm, Iwan "Pimpo" Norrman, Lars E. Lundin, Sven Stridsberg, Bo Widfeldt and the late Per Björkner and Stig Kernell for their invaluable assistance with the preparation of this feature*

Nord NC.701 Martinets in Swedish service

Registration	c/n	Previous identity	Date registered	Remarks
SE-KAE	264	New	April 1948	Withdrawn from use, ferried to the *Flygvapenmuseum*, Malmslätt, 30.12.70. Registration cancelled 20.1.71. Preserved, currently in storage
SE-KAG	265	New	April 29, 1948	Ditched in Lake Mälaren, 18.4.52. Refurbished and returned to service. Registration cancelled 12.67
SE-KAL	159	159	June 1963	Withdrawn from use; ferried to Arlanda, 23.12.70. Registration cancelled 20.1.71. Destined for future Arlanda Civil Aircaft Collection
SE-KAM	172	172	July 1963	Withdrawn from use; registration cancelled 20.1.71. Scrapped
SE-KAN	241	241	July 1963	Withdrawn from use; registration cancelled 12.67. Scrapped

Nord NC.701 Martinet

Artwork by JÖEL MESNARD © 2017



ARMCHAIR AVIATION

We take a look at what's available for the aviation history enthusiast in the world of books and other literature, from hot-off-the-press publications to reissued classics

Lighter Than Air — The Life and Times of Wing Commander N.F. Usborne RN, Pioneer of Naval Aviation

By Guy Warner; Pen & Sword Books Ltd, 47 Church Street, Barnsley, S70 2AS; 6½in x 9½in (165mm x 241mm); hardback; 320 pages; illustrated; £25. ISBN 978-1-473829-02-2

A BIOGRAPHY OF Neville Usborne was long overdue, so it is good to see the gap filled. However this is more than a biography, as the account of Usborne's life is entwined in a history of the early development of lighter-than-air military aeronautics in Britain, especially in relation to airships. Of necessity, his story weaves amidst sometimes lengthy digressions on related matters that provide essential background and connections, and include extensive quotations from contemporary sources. This tends to divert the reader from the book's professed main subject, but it is difficult to envisage how this could have been resolved, as Usborne's involvement was significant.

Usborne's naval career took an aeronautical turning when he was assigned to work on Naval Airship No 1 at Barrow-in Furness in 1911. Thenceforth he became a devoted airship man, being appointed Squadron Commander, Naval Airship Section, Royal Flying Corps Airship Wing in 1912 and subsequently making numerous flights in an assortment of British military airships. Although he gained his Aviator's Certificate, in 1913, he appears to have done little heavier-than-air flying. He also trained naval officers in free ballooning and the piloting of airships.

In July 1914 Usborne was promoted wing commander and took command of the airship station at Kingsnorth. He later played a part in the design of the SS-class airships, but in February 1916 was killed in a tragic accident with the experimental "Airship Plane" AP-1, comprising a complete B.E.2c biplane suspended beneath an airship envelope, the idea being that the craft would patrol as an airship and, if an enemy airship was sighted, the aeroplane would slip free of the envelope and engage it.

The book is well indexed, has thorough references and is profusely illustrated. Unfortunately a great many of the images are of poor quality, being murky, unevenly lit or spoilt by severe moiré effects. These avoidable problems should have been resolved during production, for they give the finished book an amateurish appearance which belies its well-researched written content.

PHILIP JARRETT

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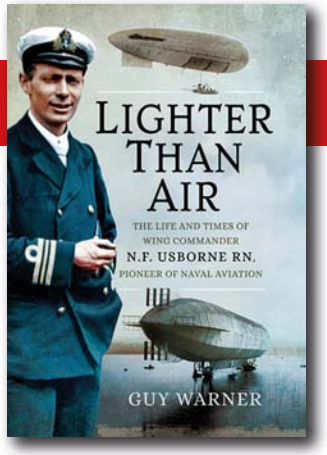
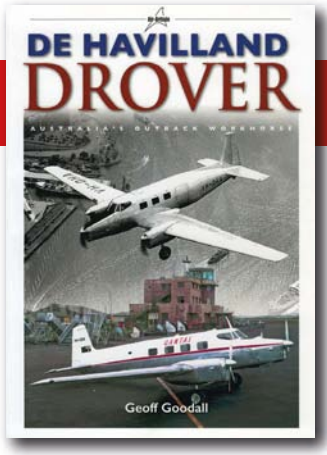
de Havilland Drover — Australian Outback Workhorse

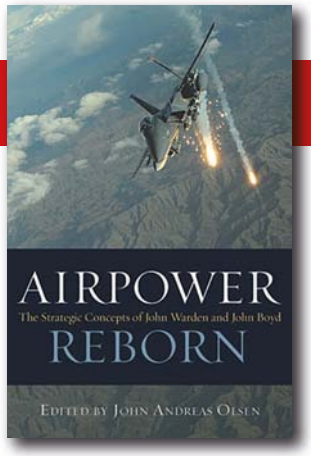
By Geoff Goodall; Air-Britain Publishing, Tonbridge, Kent TN9 1RA; 8½in x 11½in (210mm x 297mm); softback; 96 pages, illustrated; £14.95 for Air-Britain members, £19.95 for non-members. ISBN 978-0-851304-91-5

IT IS PROBABLY fair to say that the de Havilland Australia DHA-3 Drover is little known outside its homeland. Having its origins in a 1945 proposal and making its first flight in 1948, the Drover never enjoyed the success it promised, and in the end only 20 were built, in six variants. Nevertheless, the type had an interesting and varied career, largely in the vast Australian outback, from scheduled airline operations to being a mainstay of the Royal Flying Doctor Service.

Before and after the Second World War the de Havilland D.H.84 Dragon was a popular commercial aircraft in Australia. Able to carry a large load economically on just two Gipsy Major engines, it was robust and simple to maintain in the undeveloped Australian interior. As this comprehensive history makes clear, the Drover was developed by DHA as a Dragon







replacement rather than, as is sometimes said, a parallel to the parent company's contemporary and more complex D.H.104 Dove.

The design of the Drover did, however, make use of some of the structural design work done for the Dove, but the resulting aircraft was quite different in conception. The Drover was intended as a simple and rugged bush aircraft, capable of operating without sophisticated maintenance support in and out of small undeveloped airstrips. Economy and safety of operation would be provided by the installation of three Gipsy Major engines, with a large wing area (the same span as the Dove's) giving good take-off performance and load-carrying capacity, if not sparkling cruise performance.

At first the future seemed bright for the Drover, with examples being purchased by the Commonwealth Government for the Department of Civil Aviation (DCA) and the nationalised Trans-Australia Airlines (TAA) and Qantas Empire Airways (QEA). The intention was for TAA to use the Drover on its inland domestic routes connecting the sparse settlements of the outback, while QEA would use them on its internal services in Papua and New Guinea, then Australian territories.

Services got off to a good start, with both operators and passengers appreciating the additional performance and comfort over the old Dragons. However, soon tragedy was to strike with the loss of QEA's VH-EBQ in the sea off Lae, New Guinea, in July 1951. At first put down to weather-related causes, less than a year later a DCA example suffered an in-flight propeller failure, causing the aircraft to ditch off New Guinea. A few months later a propeller of Qantas' VH-EBS failed on take-off at Mackay, Queensland. The three accidents were then connected to recurring problems with the de Havilland Propellers variable-pitch props.

The latter's replacement by fixed-pitch props saw an end to the trouble, but crippled the aircraft's performance. Despite a series of modifications, it was not until the installation of American Lycoming engines with constant-speed props in the Mk 3 that the aircraft regained its full capability. But by then it was too late. Although some of the surviving aircraft were modified to the new configuration, no new aircraft were built.

This book fully describes the troubled development path of the Drover, as well as its varied service history. A section at the back gives the full service history of each of the 20 aircraft built and another contains a set of 1/72-nd scale drawings detailing each of the variants. Comprehensive photographic coverage throughout the book is complemented by four of Juanita Franzi's usual excellent colour profiles. This reviewer must declare an interest here, having contributed a few of the images.

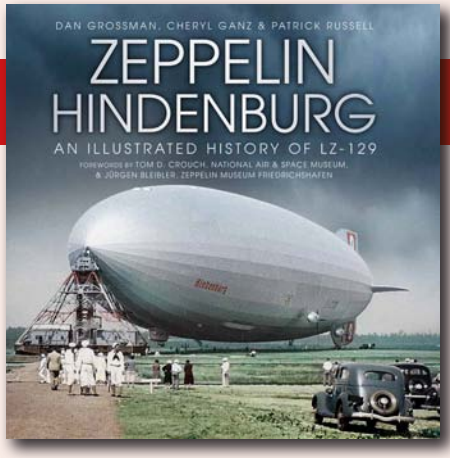
If there is a criticism to be made, it is that tighter editing could have picked up some minor errors in the text and eliminated some unnecessary repetition. Overall, this is an excellent and worthwhile monograph on a type that enjoyed a lengthy and interesting career but which has hitherto received little attention.

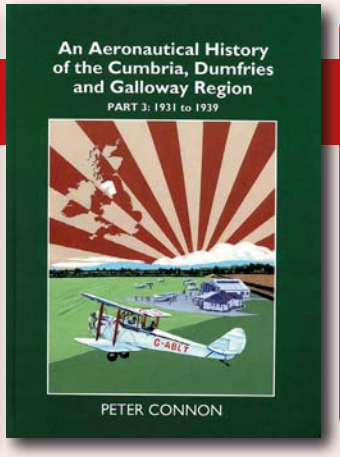
PHIL VABRE

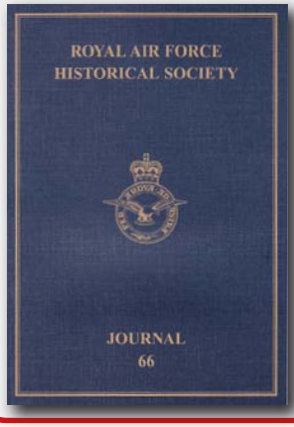
Airpower Reborn — The Strategic Concepts of John Warden and John Boyd

Edited by John Andreas Olsen; Naval Institute Press, 291 Wood Road, Annapolis, MD 21402; 6½in x 9½in (160mm x 242mm) hardback; 288 pages, illustrated; £41.95. ISBN 978-1-61251-804-6

WHAT ROLE CAN airpower play in 21st Century conflict? This is an important question for practitioners and theorists alike. In this book Col John Andreas Olsen, a noted authority on airpower, has brought together a group of leading scholars to provide a "conceptual approach [that] emphasises airpower's unique capability to achieve strategic-level *systemic*







paralysis [emphasis in original]" in war. In this, the authors seek to offer a paradigm shift from the land-centric warfare of recent years.

From the early 20th Century through to today, a key aspect of the arguments used by airpower advocates has been that it offers an efficient means of conducting war. This has not always been successful, but remains an essential element of the "Western Way of Warfare" of the last two decades. Indeed, for much of the 1990s airpower was the tool of choice for policymakers, and has apparently become so again in campaigns such as Libya in 2011 and recent air operations over Syria. It is within such a context that this book should be read.

In the first chapter, Peter Faber provides a useful overview of the main airpower theories that found traction from the First World War through to the 1980s, and offers a useful analysis and critique of these ideas. The chapter on American military strategist John Boyd, by Frans Osinga, is a *tour de force* that explores Boyd's thinking and makes the point that his ideas were not so much a "theory of, or for, airpower" but that as a conceptualisation of war, they have suggested new innovative means of engaging with an opponent. John Warden III, perhaps the key modern airpower thinker, having published *The Air Campaign: Planning for Combat* in 1988, writes the next chapter. Warden explores how to influence end states in war using airpower, and usefully concludes that if airpower is to achieve influence, then its advocates must become better at promoting ideas rather than maintaining their current focus on technology. In this, Warden promotes a "Strategy of Airpower Advocacy", which, while shifting the terms of the debate, perhaps reflects some of the problems of his predecessors.

The final two chapters, by Alan Stephens and Colin Gray, provide a way forward for the debate by arguing for an alternative conception of the conduct of war. Stephens argues for a "Fifth-Generation Strategy" based on tempo and strategic paralysis, which represents a step-change from "first generation thinking". Stephens identifies Boyd and Warden as fifth-generation thinkers, as they broke free from previous land-based paradigms. Gray's chapter is a useful list of 27 dicta relating to the employment of airpower that, while helpful, are based on his 2012 work *Airpower for Strategic Effect*. Nevertheless, they are worth restating in a work seeking to encourage discussion about airpower and national strategy.

This is a useful work that should be read by historians, practitioners and theorists alike. Not everyone will agree with the arguments presented within, but, as a work about airpower theory and its relationship with broader strategy, this effort should promote debate as we move further into the second century of airpower.

Dr ROSS MAHONEY

Zeppelin Hindenburg — An Illustrated History of LZ-129

By Dan Grossman, Cheryl Ganz and Patrick Russell; The History Press, The Mill, Brimscombe Port, Stroud, Glos GL5 2QG; 10in x 10in (258mm x 258mm) hardback with cover; 192 pages, illustrated; £30. ISBN 978-0-750969-95-6

OF THE 162 rigid airships launched between 1893 and 1938, some 99 — more than 60 per cent— met with a violent end. This sobering fact mentioned in Smithsonian Aeronautics Curator Tom Crouch's foreword provides an excellent point of departure for this sumptuous, immaculately appointed treasure trove of information on the last of those 99 ill-fated airborne luxury liners, the famous — or infamous — *Hindenburg*, the fiery demise of which in May 1937 went on to become one of the defining events of the 20th Century.

Put together by three of the world's leading

ROYAL AIR FORCE HISTORICAL SOCIETY

Edited by Wg Cdr C.G. Jefford; 5¾in x 8¼in (147mm x 210mm); 150 pages, illustrated; free to members of the Royal Air Force Historical Society, October House,Yelvertoft, Northamptonshire NN6 6LF (annual membership £18); published three times a year. Website www.raf.mod.uk/history/rafhistoricalsocietym.cfm

THE VERY SUBSTANTIAL compact-format softback journal of the RAFHistS is a compelling benefit of annual membership. The Society was formed in 1986, and its activities centre on three annual lectures/seminars in London; the journal comprises the proceedings of those events, with added historical papers and book reviews. Membership is open to everyone who has an interest in RAF history, whether or not they have been in the Service.

The latest issue at time or press, Journal 66, begins with *Some Reflections on the Employment of Air Power in the 1990s,* a lecture given by Air Chief Marshal Sir Richard Johns at the Society's 2016 AGM. It is followed by a transcript of the subsequent Q&A session and a summary of the AGM minutes. The journal then moves on to include five historical articles, on subjects ranging from the inter-war Baghdad Air Mail through World War Two topics (the often strained relationships between British senior commanders in North Africa and Normandy, plus the April 25, 1945 raid on Hitler's Berghof) to junior-officer command and staff training, and recollections of the final days of RAF Hendon. Twelve pages of book reviews complete a satisfying, scholarly read which makes a noble addition to the permanent record . **MO**

authorities on airship history, this lavishly-illustrated square-format monograph appears at first glance to be a "coffee-table" collection of beautifully-reproduced contemporary photographs and memorabilia — but it is very much more than that. Containing just about every extant photograph of the *Hindenburg* and the people involved in its construction and working environment, this visually dazzling goldmine also deals with numerous other related aspects of the gigantic airship's operation, with box-outs and double-page spreads devoted to design elements (furniture etc as well as airframe), early windtunnel testing and other important but little-covered details. Superb colour longitudinal cross-section and plan views by David Fowler are provided within a fold-out spread — pretty much a necessity when dealing with a machine more than 800ft in length.

Top marks to all involved with this thoroughly enjoyable and educationally valuable example of how to do an aviation book properly.

NICK STROUD

An Aeronautical History of the Cumbria, Dumfries and Galloway Region, Part 3: 1931–1939

By Peter Connon; Cavendish House, Cavendish Terrace, Carlisle CA3 9NF 8½in x 12in (220mm x 305mm); hardback; 448 pages, illustrated; £39.95 plus £6 p&p in UK. ISBN 979-0-950828-72-5

IN 1982 AND 1984 Peter Connon treated us to two impressive volumes covering the history of aviation in Cumbria, Dumfries and Galloway from 1825 to 1930. This new volume, taking the story up to 1939, has more than twice the number of pages as the previous two volumes combined and is equally impressive for its completeness and evidently diligent research.

Covering the period year by year and presenting the events chronologically, the author recounts every aeronautical occurrence in the area, from significant military and civil events to obscure and lesser happenings. Thus Cobham's National Aviation Day Displays rub shoulders with itinerant joy-riding outfits, and military aeroplanes and airliners share pages with privately-built Flying Fleas and gliders. The activities of local aviation companies, flying clubs and gliding fraternities are covered in detail, visiting aeroplanes and aviation personalities are recorded, and flying accidents are described. For those with catholic tastes and an affection for this exciting era, every page is a treat. Moreover, not only does the author provide very complete coverage of the personalities and events, but he also gives enlightening potted biographies of the many characters in the story. This adds to the interest, as many of them had served in the flying services during the First World War or went on to serve in the Second World War.

The main text is backed up by comprehensive endnotes and a good index, and at the front of the book there is a section devoted to amendments, additions and supplementary information relating to the two volumes published previously.

The pictorial coverage is exceptional, with a truly outstanding collection of black-and-white photographs, most of which will be new to readers. They include numerous portraits of the people featured, and the author has not fought shy of using poorer-quality images where nothing better could be found, which makes the coverage even better.

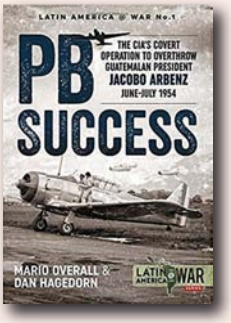
As well as being the last word on inter-war aviation in the areas covered, this is a volume that a reader can pick up, open at random and be certain of finding a good story. If you have the previous volumes this one is a must; even if you do not have them, this one is still well worth every penny.

PHILIP JARRETT

BOOKS IN BRIEF

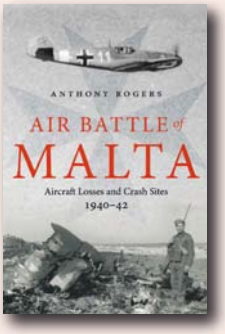
A quick round-up of what else is currently available for the aviation history enthusiast

PB SUCCESS
Mario Overall & Dan Hagedorn
Helion & Company Ltd; ISBN 978-1-910777-89-3; £25



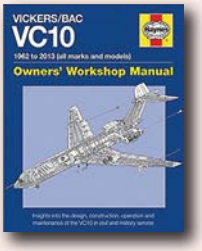
HAVING COVERED a great deal of African military aviation history in its fine *Africa @ War* series, Helion shifts its focus to another continent in this, the first of its *Latin America @ War* strand. Detaling the CIA's covert operation to overthrow the Guatemalan President Jacobo Arbenz in the summer of 1954, this softback maintains the high standard of the African titles and includes copious photographs (some of poor quality, but you can't say the authors haven't been thorough), maps and 12 artworks by Tom Cooper of the types involved, which include the AT-6, P-26 Peashooter and F-47N. **NS**

AIR BATTLE OF MALTA
Anthony Rogers
Greenhill Books; ISBN 978-1-784381-88-2; £25



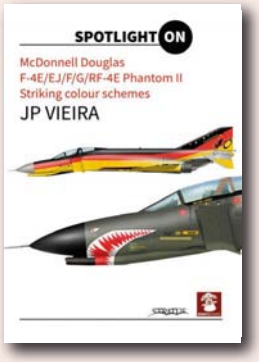
SUBTITLED *AIRCRAFT Losses and Crash Sites 1940–42,* this meticulously researched 6½in x 9½in (165mm x 241mm) hardback not only documents the location of all known air crashes — Allied and Axis — that occurred in and around the Maltese Islands during those years, but also tells the often fascinating story of each and every one. Malta's strategic location in the Mediterranean was of vital importance to both sides, and the fighting that took place in its skies was brutal and frequent. This engagingly-written tome details the various crashes in chronological order, and includes in its appendices a table containing all the details of each crash, full endnote references and a properly compiled index, making it a valuable work of reference. **NS**

VICKERS/BAC VC10 OWNERS' WORKSHOP MANUAL
Keith Wilson
Haynes Publishing; ISBN 978-0-857337-99-3; £22.99



THE MAJESTIC VC10 gets the Haynes Owners' Manual treatment, a generally effective format that just might be beginning to outstay its welcome, particularly when editorial quality control appears to be getting wobbly, as in this 196-page example. OK, "Sir Basil Smallpiece" instead of "Smallpeice" is a typo often made and almost forgivable, but "Jock Bruce" instead of "Bryce" is not. The illustrations and general content are good, but undermined by poor editing. **NS**

SPOTLIGHT ON: McDONNELL DOUGLAS F-4E/EJ/F/G/RF-4E PHANTOM II STRIKING COLOUR SCHEMES
J.P. Vieira
MMP Books; ISBN 978-83-65281-33-3; £19



ONE OF NINE high-quality hardbacks in this series from MMP, this latest 44-page slim volume contains 60 full-colour artworks (side profiles plus top and underside views) of a variety of Phantoms from all over the world, painted in eyecatching military colour schemes, special trials markings and anniversary liveries. The author, who has also created the artworks, includes notes on the colour specifications (Federal Standard etc). An excellent source of inspiration and reference for modellers. **MO**

MESSERSCHMITT Me 264 AMERIKA BOMBER
Robert Forsyth
Osprey Publishing; ISBN 978-1-472814-67-8; RRP £12.99

THE SECOND in Osprey's well-produced *X-Planes* series, in which an experimental type is covered in detail, this takes an in-depth look at Germany's wartime "Amerika Bomber", the Me 264, designed to do what it says on the tin. Written by Luftwaffe specialist (and, we must add, *TAH* Editorial Board member) Robert Forsyth, this is an eminently readable account of the development of the ambitious four-engined twin-tailed bomber which was to bomb the USA from bases in western France and the Azores. Includes excellent colour cutaways and schematic drawings. Highly recommended. **NS**

SAAB 29 "FLYGANDE TUNNAN"
Mikael Forslund
Mushroom Model Publishing; ISBN 978-8-365281-34-0; £17

THIS LATEST addition to Mushroom's 6½in x 9in (165mm x 230mm) Yellow Series of softbacks takes as its subject the Saab 29 "Flying Barrel", Europe's first swept-wing jet fighter, built in five main variants during 1948–56, all of which are covered in detail, along with the 30 J 29Fs operated by Austria. A few minor irritations aside (if you mention problems with "snaking", you should explain what it is, rather than leave less knowledgeable readers to guess), this 192-page volume crams a lot of good stuff into a compact package, much like the aircraft itself. **NS**

Lost & Found

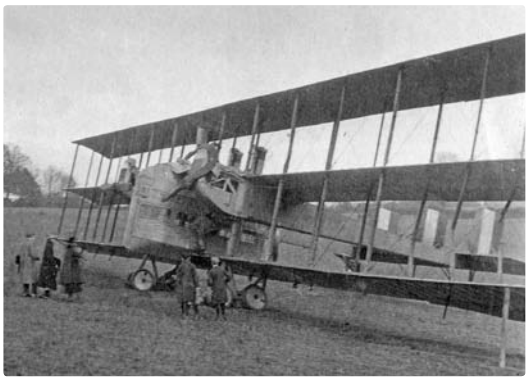
PHILIP JARRETT explores the lesser-known corners of aviation history, discovering unknown images and rediscovering long-lost details of aircraft, people and events. This time he investigates a forced landing by an Italian trimotor triplane in East Sussex in 1919

IT SEEMS EXTRAORDINARY that a forced landing by a large trimotor triplane in a Sussex field in 1919 could pass unreported, but so far I have been unsuccessful in my attempts to discover anything at all about this event.

I purchased these two photographs in 2015. Evidently cut from a personal photograph album, they carry the original caption "Italian tri-plane which came down in a field near Wadhurst — 26 Dec. 1919". The aircraft is a Caproni Ca 48, with a large passenger cabin located between the centre and lower wings. The port undercarriage unit has failed, and the four outermost interplane struts between the centre and lower port wings are broken. It therefore seems improbable that the aircraft could have been repaired on site and flown out, so why had it flown to England, and what happened to it?

So far, both an East Sussex local history group and an Italian contact have failed to find any reference to this event, and searches in contemporary aviation magazines have also proved fruitless. The fact that it happened on Boxing Day might explain why it escaped mention in the press. It has been suggested that this could have been the Ca 48 that attended the ELTA exhibition in Amsterdam, but that took place some time earlier, and, after flying in on August 25, 1919, the Ca 48 departed for Brussels on its homeward flight to Italy on September 14. That leaves a gap of nearly three and a half months before the forced landing. Another suggestion is that it had been at the Paris Aero Show, but that, too, remains unconfirmed.

If any readers can shed light on the aircraft and its ultimate fate, please contact the Editor at the usual address.



It would be reasonable to assume that the arrival of a massive double-deck triplane trimotor airliner in a local field would attract more than a little attention, but there appears to be no reports relating to the damaged Caproni Ca 48 at Wadhurst in December 1919. What was it doing in the UK and what subsequently happened to it?

hijack hijinks!

In the spring of 1978 Britannia Airways pilot ED WILD was on loan to Tradewinds Airways, then operating a small fleet of Boeing 707 freighters from Gatwick. He recalls how all was proceeding as normal during a routine cargo lift to Somalia when, at 28,000ft over the Gulf of Aden, the cockpit door suddenly crashed open . . .

IT WAS MARCH 1978. This particular flight had started with a telephone call from Tradewinds Airways Operations at Gatwick: "Hello skipper, we'd like you to do a 707 trip for us tomorrow — empty ferry to Dubai, pick up a full load and then on to Mogadishu and overnight; back into Gatwick the following day".

It would be interesting to see Somalia again. The last time I had been there was in 1960, when I had flown a Hunting Aerosurveys DC-3 while undertaking an aerial survey for Agip, the Italian oil company. Now I was working on loan to Tradewinds, seconded from my regular employer Britannia Airways, the latter having recently disposed of its own 707s. I was pleased to be doing something interesting while waiting to be reabsorbed into Britannia's package holiday operation on 737s.

Tiny Rowland, the new owner of Tradewinds and a shrewd dealmaker, had, overnight, acquired four 707 freighters in order to support his African interests, and he wanted them earning money. I never knew whether or not he realised that three of the aircraft — N5772T, N7555A and N7556A — were on the American register, and would need American-licensed crews to operate them. *[The latter two would be put on the UK register as G-WIND and G-SAIL respectively by the end of 1978 — Ed.]*

With insufficient time to train its own pilots, Tradewinds needed ready-trained and current 707 operating crews with American Federal Aviation Administration (FAA) licences. Not a man to be thwarted by officialdom, Tiny arranged to have FAA licences issued to all of the temporarily hired crews, which were already familiar with the aircraft of course.

This was achieved in record time. I received an American Air Transport Pilot Licence (ATPL) within days, already endorsed for the Boeing 707. The licence was the standard American type for the time, comprising a small grey folded card somewhat less imposing than my Luton library card. It carried one telling restriction: "Not valid for flights within the contiguous United States".

Good to go

Events moved quickly after this. An old friend, Jan Leibers, a happy, positive individual known to all as the "Flying Dutchman", took on the task of 707 Training Manager and set about making the operation legal. After

Boeing 707-323C G-BFEO (c/n 18691) was leased to Tradewinds in October 1977, previously having operated with Simba Air Cargo as 5X-UWM from 1975, before which it served with American Airlines as N7557A. It was in G-BFEO that the author had the unexpectedly exciting flight in March 1978 that he describes in this article.

TOM SINGFIELD

PHILIP JARRETT COLLECTION

ABOVE ***One of Tradewinds' 707s loads up at Gatwick. The company operated 707-300C-series aircraft, the "C" indicating "Convertible", a combined passenger/cargo variant which incorporated a 7ft x 11ft (2·1m x 3·4m) freight door in the port forward fuselage, as seen here. The Tradewinds examples had the cabin windows painted over.***

formal checks on the aircraft I was cleared for operations as captain.

I drove to Gatwick in good time for the scheduled departure and exchanged pleasantries at Tradewinds. Leafing through his pile of paperwork, weather forecasts and reports, notams, diplomatic clearances and load details, the Operations Officer said that there would now be a small outbound load — a single passenger — for Mogadishu, accompanying "printed matter".

On board, a short, quiet character was already seated in one of the triples at the front, near the flightdeck, a sturdy but well-used leather briefcase attached to his wrist by a single handcuff. Alongside him a wooden crate was securely lashed to the floor. I introduced myself to him and asked what the box contained. With nervous glances to see who was in earshot he said "Bank notes, new currency for Somalia". As I headed for the cockpit the loadmaster took me aside: "Who's the mystery man?" I told him what I knew.

Into the heart of darkness

Loading at Dubai had been unusually speedy and it had got dark, but we were soon airborne again and on our way to Mogadishu. At Dubai we had uplifted nearly 38 tons of freight in large crates labelled "UNIFORMS". Initially we had to settle for FL 280 (28,000ft/8,500m) as our cruising altitude, but after the heat of Dubai the cooler air now flowing from the cockpit air ducts provided a welcome relief. I eased my damp shirt away from the sticky seat-back and looked across at the copilot; he was talking to a distant station on HF radio. This was always a frustrating process on African flights, rather like a conversation in a crowded pub at closing time. The flight engineer had gone back into the cabin following a short discussion with the loadmaster.

The 707 was a quirky aircraft in some ways, having reached the end of its development by this point and heavy at a third-of-a-million pounds maximum take-off weight. On long flexible wings, the ailerons operated only at low speeds, high-speed roll control being achieved via inboard differential spoilers. Roll control sometimes became an issue on landing, when pilots new to the type tended to overcontrol, with the aircraft sometimes taking on alarming bank angles. This was pilot-induced oscillation, startling for those unfamiliar with it; someone described it as like taking a big dog for a walk.

The take-off roll on Britannia Airways' non-stop flights from Los Angeles to Luton were drawn-out affairs. An LA air traffic controller I met in a bar one evening said: "You know, the only take-offs everyone in the tower watches are those by Britannia and Dan-Air; boy, they

PETER WILD / LICENCE: AUTHOR'S COLLECTION

ABOVE ***The author in the left-hand seat of Sudan Airways 707-3J8C ST-AFB during a London—Frankfurt—Rome—Khartoum flight in November 1979, with copilot Jack Murrell.*** **BELOW** ***The author's hastily-arranged FAA Airline Transport Pilot Licence, required in order to fly Tradewinds' 707s, several of which were registered in the USA.***

look nail-biting!". They were. Speed built painfully slowly as the runway lights gradually accelerated past. There was an interminable wait for the "rotate" call as we saw sand dunes rearing up at us in the glare from our landing lights. Eventually we lifted off and roared over the beach into the black Pacific night.

During an earlier visit to Boeing Field in Seattle I had seen a row of 707 outboard engine pods standing like headstones in an old churchyard. The cowlings were awaiting repairs to the undersides, which had been in contact with the runway surface during landing. Only modest bank angles at touchdown were necessary to bring about this embarrassment — an occurrence often followed by an invitation to take Monday morning tea and biscuits with the Chief Pilot.

The 707 also suffered from inadequate air conditioning, particularly on the flightdeck, with the result that crews became dehydrated during the course of the very long sectors of which the aircraft was capable. Despite its shortcomings, however, the 707 freighter was a real long-range workhorse and gave sterling service worldwide.

No laughing matter . . .

Back to the flight to Mogadishu. Night had fallen and lights bordering the Gulf of Aden came into sight. I looked for the Horn of Africa, recalling the occasion I flew a Hunting Aerosurveys DC-3 into Alula to collect a large quantity of Avgas left on the beach by the Shell Company in 44gal drums, stocks at Agip's base-camp desert strip having run low.

Now peering forward into the blackness, I perceived the great dark continent looking silently back through the cockpit windows, and I began wondering what was taking the flight engineer so long at the rear. As I reached for the public-address microphone, an alarming event took place. There was a muffled bang as the flightdeck door crashed violently open and shouts filled the cockpit. I twisted in my seat to see someone wearing a chequered headdress covering much of his face and pointing a shoulder-launched missile into the cockpit.

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Sub-leased to Sudan Airways in January 1980, G-BFEO was returned to Tradewinds two months later and operated with the company until it was withdrawn from use in 1985 and broken up for parts for KC-135s. The remains have been in storage at Davis-Monthan, Arizona, since April 1986.

TAH ARCHIVE

In the cabin behind him I dimly saw the face of the loadmaster and, looking over his shoulder, the mystery man who had joined us at Gatwick that morning; he was grinning now. Realisation dawned alarmingly. We were being hijacked!

Concern quickly turned into something else as it became apparent that everyone had started laughing — except me. The "hijacker" pulled off his headscarf to reveal the grinning features of our own flight engineer. He had cooked up this ruse with the loadmaster who, after departure from Dubai, had become suspicious about the contents of the boxes, prised one open and discovered not the stiff sand-coloured military garments stated in the airway bill, but an array of machine-guns and rocket-propelled grenade-launchers. The Arab headdress he was wearing turned out to be a large tea-towel from the aircraft's onboard food locker. With the exception of the two pilots, the entire crew had been in on the joke.

Moscow's paparazzi

With my heartbeat back down to its normal rate, we continued on to Mogadishu and landed at dawn without further incident. Our allotted parking place was directly opposite a large Russian freighter which had landed a short time ahead of us and had commenced unloading. It was daylight by now, and the presence of the Russians afforded some further amusement for our jolly bunch.

The fun started when one member came into the cockpit to tell me that we were being photographed by a Russian crewman. Sure enough, there was a photographer with a large camera on a tripod, clicking away steadily. I'm unsure whether he was recording the occupants of our aircraft or perhaps hoped to glean information about the nature of our cargo.

One crew member went out on to the aircraft stairs in a variety of dress: hat; no hat; hat on backwards; tie; no tie. These changes of costume were duly recorded by our Russian David Bailey. I'm sure he had his orders, but wondered just what intelligence analysts in the corridors of power in the Kremlin, eager to please their masters, would make of this impromptu fashion show in dusty Somalia.

After the long flight there was now going to be a delay in unloading. Our presence plus the Russian aircraft had overstretched the flimsy local infrastructure. The mystery man and his crate of banknotes had been whisked away under armed guard almost as soon as the freight door was raised, and we were now looking forward to getting our heads down. Thankfully, our handling agent was arranging transport.

When we boarded the crew bus I decided to retaliate for the hijack hoax by regaling them with the (absolutely true) tale of the last occasion I had night-stopped in Mogadishu. We had stayed in the old abandoned Italian Sergeants' Mess. Sleeping on straw palliasses, we were covered in bites for days afterwards and itched furiously; the straw was overrun with lice. Sure enough, the story got their attention and some were surreptitiously scratching by the time I had finished.

On the way to our hotel for our minimum rest, the rusty bus bumped its way through the streets of Mogadishu, capital of this utterly sad and bankrupt country, horn blaring feebly and incessantly at the people and donkeys

occupying the dusty road. *Khat*-chewing men observed us with hostile stares; childishly crude paintings proclaiming an incumbent warlord or politician decorated the walls; children played listlessly and young mothers nursed skeletal babies. Somalia had it all: war; drought; disease and starvation, plus border disputes with every neighbouring country. It was upsetting to think that to all of this we had now unwittingly brought the means of even more death, misery and corruption.

All change

Following our rest period we departed Mogadishu and were soon at cruising height. Time to call the company. This was a routine practice so that Operations was aware of our status. In common with many other operators, Tradewinds did not have its own high-frequency radio set-up, so contact was accomplished by calling Berne Radio in Switzerland, where there was an efficient aerial array, and which provided a service by "patching" our radio calls into the telephone system so that we could speak directly to Operations at Gatwick.

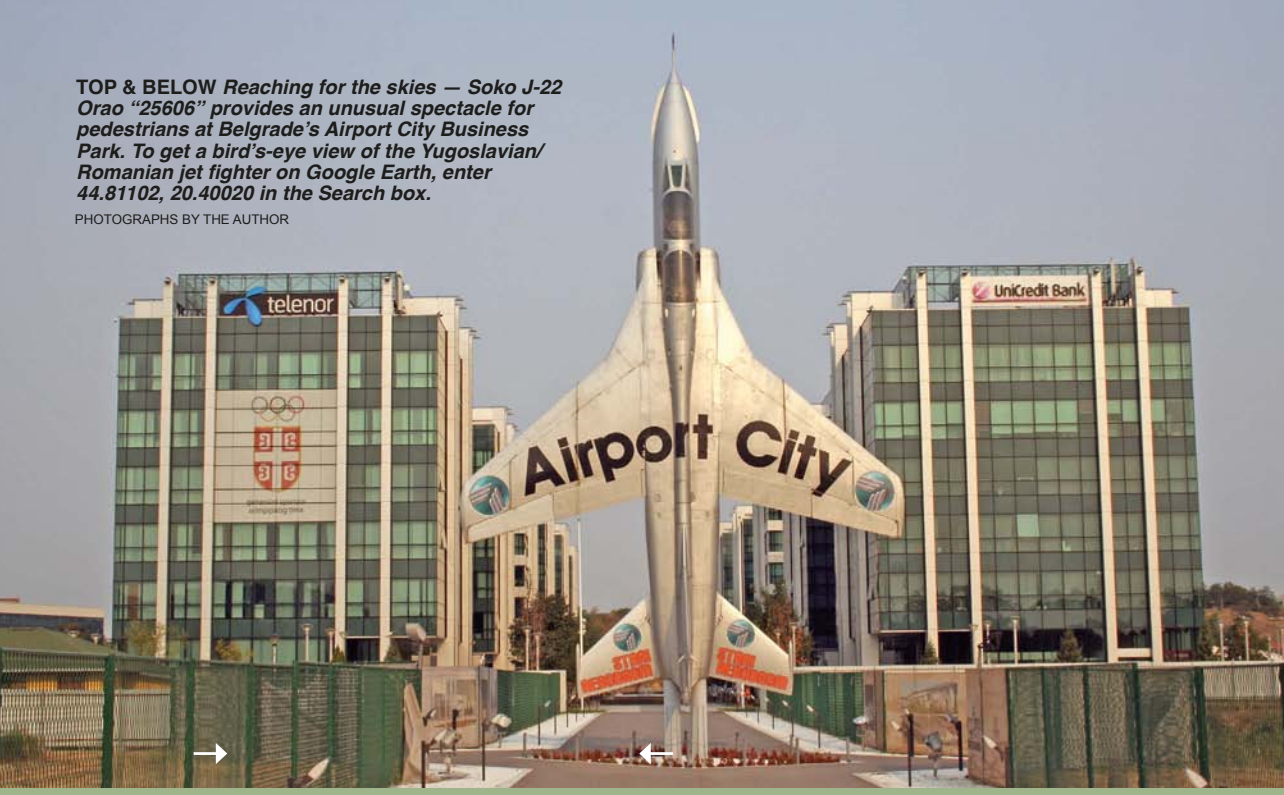
As soon as I had connected, the duty officer cut short my routine transmission about serviceability and estimate for Gatwick, and asked, "We've just picked up a charter out of Hong Kong; have you got enough fuel to make it from there?" I said I would call back very shortly with an answer. He followed up with, "By the way your wife is on another line asking when you will be home. Do you want a quick word with her?" The way the telephone patch worked was that both parties were transmitting in the clear. This meant that anyone with a radio capable of receiving the frequencies used can listen in to conversations. Caution is the watchword as the audience is large. Bored radio operators who were just killing time before their shift ended suddenly became alert, and probably motioned their colleagues to listen in too.

Unsurprisingly my wife was unaware of this and a mainly one-way conversation followed detailing how our boiler was "on the blink again" and the fact that our dog was ill. My efforts to mute these domestic diversions were ineffective but we probably brought smiles to a number of people that day.

Once again I reflected on how the air-freighting business provided a combination of unusual tasks, uncertainty and enjoyment that my more usual holiday flights — taking happy groups of bucket-and-spade punters on their annual holidays — certainly did not!

BELOW ***Cut-price cargo operators based in the developing world and new UK regulations requiring the expensive hush-kitting of its 707s forced Tradewinds to cease trading in January 1986, when G-TRAD made the company's last flight from Gatwick, as seen here. The company was acquired by new owners but lasted only until 1991.***

TOM SINGFIELD



TOP & BELOW ***Reaching for the skies — Soko J-22 Orao "25606" provides an unusual spectacle for pedestrians at Belgrade's Airport City Business Park. To get a bird's-eye view of the Yugoslavian/ Romanian jet fighter on Google Earth, enter 44.81102, 20.40020 in the Search box.***

PHOTOGRAPHS BY THE AUTHOR

OFF THE BEATEN TRACK

Ever turned a corner to find something unexpected? The Aviation Historian's *intrepid aeronautical explorer* ***PETER DAVISON*** *investigates the stories behind the oddities that turn up in the most unusual places . . .*

THE GROWTH OF mass production and ever-increasing development costs have for some time filled the air arms of Europe with more examples of fewer types, so the profile of the 1970s-vintage Yugoslavian/Romanian Soko J-22 Orao (Eagle) and IAR93 Vultur jet fighter is rarely seen.

Powered by two licence-built Rolls-Royce Viper 632 turbojet engines, the J-22 Orao first flew at Belgrade's Batajnica Air Base in November 1974, the ground-attack aircraft achieving supersonic speed in a dive in 1984, the first Yugoslavian-designed aircraft to do so. By 1992, the Mostar production line had built some 200 aircraft. Fitted with five wing-mounted hardpoints, the Orao can tote a weapons load of 6,170lb (2,800kg) and also carries a pair of 23mm cannon. Limited action was undertaken with the type over Croatia in 1991 and during the Bosnian war of 1992. Of robust construction, the type was designed to be able to operate from unprepared airstrips.

This example, serial 25606, is displayed dramatically in a vertical climb at the Airport City Business Park, constructed on the site of Belgrade's Bežanija Airport, which was orginally built in 1927 but was destroyed by German bombing in 1944. It was subsequently restored, but finally terminated operations and was closed in 1962. The Orao is seen here in September 2012.

TOMMY CULLEN

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